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NO. 24

1 SEPTEMBER 1944

ENEMY TACTICS IN CHEMICAL WARFARE

MILITARY INTELLIGENCE DIVISION

WAR DEPARTMENT . . . WASHINGTON, D. C.

[redacted]

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CONTENTS

PART 1. GERMANY—Continued.

Section II. Smoke—Continued.

Section III. Flame-Thrower Tactics.

PART 1. GERMANY—Continued.

Section IV. Incendiary Tactics.

PART 2. JAPAN.

Section I. Gas.

PART 2. JAPAN—Continued.

Section II. Smoke Tactics.

Section III. Flame-Thrower Tactics.

Section IV. Incendiary Tactics.

ILLUSTRATIONS

FOREWORD

The purpose of this study is to state and explain what is known about enemy theories of the use of chemical agents in battle and the methods of applying them so that we may understand his actions and anticipate his movements. The tactical principles discussed and the technical processes described should not be mistaken for those of the United States Army, although many close similarities are apparent. It is not intended in the least to suggest methods of employing our own chemical warfare troops, except so far as knowledge of the enemy may contribute to effective counteraction.

The study consists of a digest, with interpretations, of a great many writings of the enemy. Much of the material already has been published in isolated articles or given limited distribution in several forms. All information has been assembled here, however, and primarily focused upon the subject of tactics in chemical warfare. In addition, reports have been included of actual examples of the use of chemical warfare tactics by the enemy in the present war. Where such examples have been available these tend to confirm that the written tactical doctrine is generally followed in combat.

A literal translation of foreign documents often gives wrong impressions to readers not acquainted with the language or practices of the originator. On the other hand, the use of the accepted terminology of our own Chemical Warfare Service would perhaps mislead the reader into the assumption that enemy techniques correspond more closely to our own than is the case. Therefore, enemy theory and practices have been stated as nearly as possible in those United States equivalents which convey the ideas, but do not necessarily represent the actual language either of enemy military writing or of the United States Army.

In discussing chemical warfare it is not always possible to separate tactics from technique. In general *tactics* means the determination of the time and place for the use of chemical agents in conjunction with the employment of combat troops. *Technique* can be defined as the methods by which chemical agents are dispersed at the proper time upon the targets that tactical considerations have selected. In many cases in chemical warfare, the two are so closely linked that it is necessary to understand

the techniques used or available, to comprehend fully the tactics that may be used in a given situation.

The diagrams and sketches, also, are taken from enemy publications. All have been redrawn for clarity and intelligibility. The Japanese tactical diagrams, however, are like nothing usually found in the military writings of western nations. They have been copied and clarified only as the requirements of reproduction demanded.

Information presented in this book is believed to be complete and accurate according to sources available to 1 July 1944.

Part 1. GERMANY

Section I. GAS

1. MUNITIONS. a. Shells. (1) *Characteristics.* The Germans developed the method of classifying gas munitions according to their physiological effects in the field. While they do not employ strictly tactical classifications of gases, they mark shells and prescribe their use according to a system that combines physiological and tactical considerations.

German gas shells are divided into two types: those with considerable high-explosive effect, called "gas/HE shell"; and those with slight high-explosive effect, termed "true gas shell." They are marked with rings of different colors, which have displaced the crosses formerly used. Both the physiological action of the chemical filling and the expected tactical use are indicated by these markings.

Throughout German gas-firing instructions, gas shells are referred to by these ring designations without any indication of the name or chemical composition of the filling. The colors of the rings also are associated with specific tactical requirements. Thus, white-ring and blue-ring may mark harassing shells, while yellow-ring and green-ring denote casualty shells. However, all four may be fired at the same time as high-explosive and smoke ammunition, and may, as is shown later (par. 1a (2)), be mixed with each other in several combinations.

Gas/HE shells contain approximately equal amounts of gas and high explosive. They are said to have splinter effect that may amount to, or even exceed, 50% of that of an ordinary HE shell. The chemical agents carried by these shells may be of high or low volatility. Those of low volatility are dispersed widely, in a gas cloud with an effect similar to that of highly volatile, non-persistent chemical agents. However, after the vapors have been conveyed into low or sheltered places, the persistency of the agent causes them to remain in effective concentrations "for many hours." The explosion, which is said to be indistinguishable from that of ordinary high-explosive shells, conceals the actual nature of the gas bombardment. True gas shells, on the other hand, contain explosive only in the burster charge and are not designed to produce great fragmentation.[1]

[1] The only true gas shells described in available German documents are yellow-ring and double-yellow ring, filled with persistent agents. Nonpersistent gas, in the shell described, is always mixed with HE.

According to the German manual on gas bombardment, the following gas shells are available for long-range weapons:

White ring. Gas/HE shell; HE effect 50–60%. Smells like almonds.

This gas causes irritation of the eyes, nose, and throat; small amounts will necessitate the wearing of masks.

Blue-ring 1. Gas/HE shell; HE effect 60–90%. Smells musty.

This causes vomiting, but has delayed action. It precludes wearing of the mask after its effects begin and thus prepares the way for subsequent use of choking gases.

Blue-ring 2. Gas/HE shell; HE effect approximately 65%. Smell is reminiscent of ink.

Its effects are the same as those of blue-ring 1 but approximately double in intensity. The beginning and subsidence of the effects are more rapid than those produced by blue-ring 1.

Green-ring (obsolescent[2]). Gas/HE shell; HE effect, about 65%. Has no number, but is marked: $\frac{\text{G b}}{\text{L O.}}$ Smell, which is slight, resembles that of mustard gas.

This gas produces a choking effect from the irritation of respiratory passages and lungs. An area bombarded with this shell will be contaminated for about 24 hours. Gas masks must be worn, and troops lying down in the area must expect some skin injury. Within craters the danger can last for several days.

Green-ring 1 (with figure "38" on shell body). Gas/HE shell; HE effect, approximately 65%. Hardly any smell (*kaum vorhanden*).

The effects are similar to those of green-ring-yellow shell (below). "The almost complete absence of any smell in conjunction with the violent burst make these shells particularly suitable for surprising the enemy."

Green-ring-yellow (with figure "38" on shell body). Gas/HE shell; HE effect, approximately 65%. Smell, which is slight, resembles that of mustard gas. The yellow border on the green ring is to warn ammunition handlers of the vesicant action of the filling if leaks are encountered.

The gas, intended to supplant green-ring shell, causes injury to respiratory tract and lungs and, to a lesser degree, to the skin. The action of the agent begins 2 to 6 hours after breathing. Contaminated terrain can be crossed immediately after firing has ceased, but slight skin injury cannot be avoided by troops who lie down in it. After 4 to 6 hours, however, this danger need not be considered.

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[2] Green-ring shells were announced to be superseded by green-ring-yellow in 1940. It is not known whether they are still available.

Yellow ring (without a number, but stamped: $\frac{\text{G b}}{\text{G/B}}$). True gas shell; HE effect, slight. Smells strongly of mustard gas. (Obsolescent; to be superseded by double yellow-ring with figure "39").

The filling is a persistent vesicant, and contamination remains effective for hours or days. During this period shelled ground should not be crossed by troops without protective clothing. (Ordinary clothing is no safeguard although well-cared-for boots offer some protection.) The effect on the skin begins at least 2 hours after contact. Evaporating gas from a contaminated area attacks the eyes and breathing passages, and in warm weather the vapor will affect the skin through clothing without immediate contact.

Double yellow-ring (with figure "39"). True gas shell; HE effect, slight. Smells strongly of mustard gas. (To "be supplied later." [3]) The gas acts in the same way as yellow-ring (above), but contamination lasts for days or even weeks. The subsidiary effect of the gas cloud, however, persists no longer than that from yellow-ring shell.

Various fillings, having the same action, are distinguished by the figures 1, 2, etc., in addition to the rings; the number of rings indicates the relative persistence of the filling.

(2) *Tactical uses.* The following rules govern the tactical use of the various German shells:

White-ring shells are not fired before blue-ring or green-ring, since it would cause enemy troops to mask and thus nullify the effects that might be expected from the later fire. An exception to this rule may be made: white-ring harassing fire, lasting for several days, may be employed, followed after an interval of 12 hours by green-ring fire for casualty effect.

Green-ring shells are not fired simultaneously with other gas shells, for this will prevent the surprise otherwise incident to their lack of odor. On the other hand, green-ring 1 may be fired simultaneously with HE shells, if sufficient quantities are used to attain the gas objective. This technique is regarded as very effective.

For surprise or harassing fire, blue-ring or green-ring shells are employed. A combination called *Buntschiessen* (multicolored-shoot) also may be used. In this special case, blue-ring is fired before green-ring for its harassing effect and to prevent the wearing of the gas mask during the green-ring shoot.

Yellow-ring shells are fired only if there is no intention to cross contaminated terrain.

b. Static Munitions. (1) *Gas Mines.* The German chemical mine 37 (*Sprühbüchse*—spray can—*37*) is structurally similar to the antipersonnel S-mine and functions in the same way. It consists of two parts: an

[3] So stated in 1940. Probably now available.

outer casing which serves as projector and contains the propellant charge, and an inner container which is a closed cylindrical vessel of 2-gallons capacity. The inner vessel is fitted with a column of short-delay fuse composition (in a wooden tube), a cap, a detonator, and a burster charge. The delay fuse is timed to allow the container to be projected 20 to 24 feet into the air before it bursts. The mine may be fired electrically, or by time, pressure, pull, or scatter igniters. It is stated that the time igniter, which may be set for delays from 1 to 5 minutes, is the only one used by chemical troops.

The mine is buried about 2 inches below the surface. When it is fired, the inner container is ejected upward at the same time that the delay fuse is ignited. The burster charge is fired when the mine reaches a height above ground of about 20 feet. The dispersed gas contaminates an area of 300 to 500 square yards; 81 chemical mines spaced at 12-yard intervals will produce a contamination of 100 grams per square meter (0.32 ounces per square foot) over an area of 100,000 square feet.

The Germans recommend gas mines for contaminating demolitions, obstacles, and buildings, or ground that cannot be crossed by bulk contaminating vehicles. Their use is suggested for contaminated ground just before an enemy attack, or upon the withdrawal of friendly troops, particularly when the ground is covered by enemy observed fire. After the withdrawal of friendly troops, gas mines may also be employed to contaminate uncontaminated lanes in areas otherwise contaminated. The uses envisaged by the Germans consider the functioning of the mines by themselves, only. However, since they mention a variety of igniters for possible use, it has been suggested that the mines might be set to be detonated by attacking troops by means of trip wires, etc.

The Germans have possession of the stocks of the Czech firm Chema, which include Chema gas mines. These mines, which are projected into the air 20 to 25 feet, are said to contaminate an area of 2,700 square feet each. They also can be removed from the projection case and fired in place to contaminate obstacles or demolitions.

(2) *Vomiting gas generators.* Evidence of German possession of vomiting gas (toxic smoke) generators is not conclusive. They do have a candle made by Stoltzenberg of Hamburg, possibly composed of DA, which is not believed to be very efficient. They may have, also, Chema (Czech) arsenical or tear-gas candles and the French *"Engin Z,"* a DM generator with an emission period of 8 minutes. The Germans are reported to have thought, before it fell into their hands, that the *"Engin Z"* might be effectively used against them.

c. Grenades. Little is known about German gas grenades. Vague reports have been received about a stick grenade 24; and the Germans may have adopted the Norwegian Aasen grenade, which contains BA, a tear gas. A German egg-shaped grenade, containing CN, was captured in 1943. There are also reports about glass grenades filled with gas.

d. Spray Vehicles. Spray (bulk contamination) vehicles used to contaminate ground are available in two German models, light and medium. One medium spray vehicle can contaminate a strip 12 by 1,100 yards to a concentration of 100 grams per square meter (0.32 ounces per square foot). The spray can be adjusted to contaminate strips up to 50 feet in width. The speed of the vehicle is regulated by the width of the strip being contaminated, that is, the wider the strip, the slower the speed. An average employment is to contaminate a 20-foot-wide strip at a speed of 5.6 miles per hour. Two types of Chema (Czech) trucks are also available for ground contamination. The heavier, which weighs 11.6 tons and draws a 6.6-ton trailer, appears, however, to be a tank truck for refilling vesicant munitions. Both Chema trucks can be used to pump bleach for decontamination.

2. WEAPONS. Mortars and rocket projectors, the basic weapons of chemical troops, as well as artillery guns and howitzers, are used to project chemical agents. Infantry howitzers and mortars may also be employed. The principal characteristics of these weapons when they are used for chemical warfare, and the ammunition known to be available for them are given below in figures 1, 2, and 3.

Weapon	Projectile					
	German name and type	Length (inches)	Weight	Chemical filling		Range (yards)
				Type	Weight	
20-mm Aircraft MG (Mauser *MG 151/20*)	*Pz Brgr Patr (Ph) o Zerl* (armor-piercing incendiary cartridge)	5.73	3,140 grains.	Phosphorus.....	52 grains.....	.....
	Pz [illegible] Patr Elektron o Zerl [illegible]g incendiary	.....	.....	Thermite.....	.....	.....
	Pr [illegible] [illegible]plosive incendiary [illegible]s with and without tracers)	5. 73	2, 772–3, 070 grains.	PETN aluminum or PETN wax plus incendiary	61–70 grains..	.....
20-mm AA guns (Solothurn *Flak 30* and *Flak 38*)	*Pzgr Patr L'Spur Ph* (armor-piercing incendiary cartridge).	7. 98	4, 946 grains.	Phosphorus.....	42 grains.....	.....
20-mm AA gun on 4-barreled mount (Solothurn *Flak-vierling 38*)	*Br Sprgr m L'Spur*.....	7. 98	4, 480 grains.	PETN aluminum...	106 grains.....	.....
20-mm AT guns (Solothurn *KwK 30* and *KwK 38*)	*Br Sprgr v K L'Spur* (explosive incendiary cartridges with tracers)	7. 98		Cyclonite wax.....	.....	.....
20-mm Aircraft gun mounted in wing (Oerlikon *MG-FFM*)	*Br Sprgr Patr L'Spur* (explosive incendiary cartridges with tracers—3 types).	5. 69	.....	PETN wax plus Thermite or other incendiary	60–69 grains..	.....
	Pz Brgr Patr Ph FFM o Zerl (armor-piercing incendiary cartridge).	5. 69	.....	Phosphorus.....	.....	.....

27-mm Grenade pistol (*Kampfpistole*)	*Nbgr Patr* Z (smoke cartridge)	.....	.....	Smoke	.....	110–450
	Deutpatrone Z (smoke indicator cartridge)	5. 08	4. 5 oz	Red-brown smoke composition (other colors reported)	.....	110–450
	'auchbundelba violett or cluster signal cartridges, violet, also blue)	5. 3	3. 16 oz	Violet or blue smoke composition	0. 95 oz	.....
37-mm AA guns (*Flak 18, Flak 36, Flak 37*)	*Br Spr v K L'Spur* (explosive incendiary projectile)	.....	1 lb 6. 7 oz	Cyclonite Montan Wax	.....	.....
50-mm AA gun (*Flak 41*)	*Br Sprgr 41 L'Spur* (explosive incendiary projectile with tracer)	.....	.....	Thermite	3. 4 oz	.....
75-mm L inf how (*leichter Infanteriegeschutz 18*)	*K Gr rot Nb* (rotating smoke shell)	11. 5 (without fuze)	13.6 lb	Oleum in pumice	2 lb	2, 980 –10, 310
	K Gr rot Deut or Igr Deut (smoke indicator shell, rotating)	.....	13 lb	.....	.....	.....
75-mm L mtn inf how (*leichter Infanteriegebirgsgeschutz 36*)	*K Gr rot Buntrauch* (varicolored smoke shell)	.....	12.8 lb	.....	.....	10, 116
75-mm light field gun (*leichte Feldkanone 18*)	Gas shell	.....	.....	White ring	.....	.....
75-mm Tractor-drawn or tank-mounted gun (*Kraftwagen Kanone 38* and *40*)	*Nbgr Patr* (smoke shell)	13. 15	16 lb 12 oz	Oleum in pumice	.....	55–4, 374
75-mm Assault gun (*Sturmkanone 40*)	*Gr Nb* (smoke shell)	11. 5	13.7 lb	Oleum in pumice	350 cc	3, 800
75-mm Assault how (*Sturmgeschutz*)						
80-mm Hv inf mort (*schwere Granatwerfer 34*)	*Wgr 34 Nb* (smoke shell)	12. 94	7.85 lb	.....	.....	66–2, 078
	Wgr 38 Nb (smoke shell with delay)	.....	.....	.....	.....	.....
	Wgr 38 Deut (blue smoke indicator shell)	.....	.....	.....	.....	66–2, 078
	Gas shell	.....	.....	White ring	.....	.....

Figure 1. Miscellaneous German weapons firing chemical warfare munitions.

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Weapon	Projectile					
	German name and type	Length (inches)	Weight	Chemical filling		Range (yards)
				Type	Weight	
88-mm Smoke-pot discharger (*Nebelkerzen Wurfgerät*)	*Nb K 39* (smoke pot)	5. 75	4 lb	Berger mixture		Up to 550
105-mm smoke mort (*Nebelwerfer 35*)	*Wgr Nb* (smoke shell)		16 lb			
	Gas shells			Yellow ring, double yellow ring		
105-mm Smoke mort (*Nebelwerfer 40*)	*Wgr 40 Nb*		19 lb			550–6, 780
	Wgr 40 w Kh Nb (smoke shells)					
	Gas shell			Yellow ring		
105-mm Turret how SP? (*l.F.H. 18* on SP mount?)	*Wgr 40 Nb le HT, Wgr 40 W Kh. Nb le HT* (smoke shells)					
105-mm Gun hows (*l. F. H. 16, 18, 18M*).	*FH Gr 38 Nb* (smoke shell)		30.8 lb	Oleum in pumice	4.1 lb	3, 910–11, 670
	FH Gr 41 NB (smoke shell)	19. 25	30.8 lb	Oleum in pumice	4.1 lb	3, 910–11, 670
105-mm Gun hows on SP mounts (*l. F. H. 18/2 sfl "Wespe"* and *Stu H42 on Sd Kfz 142*).	*FH Gr 40 Deut* (blue smoke indicator shell).		32.3 lb			
	FH Gr Brand (incendiary shell)		34 lb 13 oz			
	Gas shells			White ring, green ring, green ring yellow 38, yellow ring, double yellow ring 39, blue ring 1, blue ring 2, green ring 1		

105-mm Recoilless airborne guns (*LG 2, LG 40, LG 42, LG 2-350*).	*Nebelgr* (smoke shell) *Brandgr* (incendiary shell)					
120-mm mort (based on Finnish model)	Smoke shell Smoke shell		27. 5 lb 47. 3 lb		3 pints 10 pints	7, 546 4, 921
150-mm Medium field how (*s. F. H. 18*): mounted on *Pz Kpfw IV*—"Bumble Bee"—chassis (*s. F. H. 18/1, sfl IV, "Hummel"*), or in fortification turret (*schwere Haubitzer Turm*)	*Gr 19 Nb* (smoke shell) *Gr 38 Nb* (smoke shell) Gas shells	26. 5 26. 5	95.7 lb 85.8 lb	 Oleum in pumice White ring, green ring, green ring yellow 38, yellow ring, double yellow ring 39, blue ring 1	 13 lb	4, 370–14, 750 4, 370–14, 380
150-mm Medium field how on French Lorraine chassis (*s. F. H. 13 on sfl "Lorraine"*)	Smoke shell		85.8 lb			9, 300
150-mm Hv inf how (*s. I. G. 33*) 150-mm Hv inf how mounted on *Pz Kpfw. II* chassis (*s. I. G. 33 sfl auf Pz Kpfw. II*)	*Igr 38 Nb* (Smoke shell) Gas shell	23. 19	84.7 lb	Oleum in pumice Green ring	14.3 lb	1, 610–6, 000
200-mm Light spigot mort (*leichter Ladungswerfer 40*)	*Wurfgranate 40 Nb* (smoke shell)		46¾ lb			766
380-mm Hv spigot mort (*schwerer Ladungswerfer 40*)	*Wurfgranate 40 Nb* (smoke shell)	4 ft 11 in	331 lb			

Figure 1. Miscellaneous German weapons firing chemical warfare munitions—Continued.

Weapon	Projectiles					
	Name	Length (inches)	Weight (grains)	Chemical filling		Range (yards)
				Type	Weight (grains)	
7.92-mm Rifle (*Gewehr 98*) 7.92-mm Carbines (*Karabiner 98, 98K*, and *98B*)	*Patr. P. mk* [1]	3. 17	359	Incendiary (phosphorus)	0. 5	
7.92-mm MGs (*MG 34* and *42*)	*Pm k.v* [1]	3. 17	372	Incendiary (phosphorus)	0. 5	
7.92-mm Parachutist auto rifle (*Fallschirmgewehr 42*)	*B Patr*	3. 17	375	Incendiary (phosphorus)	6	
7.92-mm Aircraft MGs (*MG 15* and *MG 17*)	*BV* [1] (explosive incendiary cartridges).	3. 17		Incendiary (phosphorus)	6	
7.92-mm carbine and grenade discharger (*Karabiner 98K*)	*Gewehrblendgranate 42* (antitank smoke rifle grenade for blinding)					
	(defensive smoke rifle grenade).					
7.92-mm AT rifles (*Pz. B. 38* and *Pz. B. 39*)	*Patr 318 smk (H. Rs) L'Spur* (gas armor - piercing bullet with tracer).		1, 315	Chloracetophenone (tear gas).	4	250–300

13-mm Aircraft MG (Solothurn *MG 131 El*)	*Br. Sprgr. Patr L'Spur El o Zerl* (explosive incendiary cartridge with tracer).	4. 1	1, 150	Incendiary PETN wax thermite.	18	.....
15-mm Aircraft MG (Mauser *MG 151*)	*Br. Sprgr. Patr L'Spur ö Zerl* (explosive incendiary cartridge with tracer).	5. 76	2, 438	Incendiary PETN wax incendiary pellet.	49. 3	.....

[1] Primarily for use in aircraft machine guns.

Figure 2. German small arms using chemical warfare munitions.

Weapon	Projectile					
	German name and type	Length (inches)	Weight (pounds)	Chemical filling		Range (yards)
				Type	Weight or volume	
150-mm single-frame rocket projector (*15 cm Do-Gerät 38*) 150-mm 6-barreled rocket projector (*15 cm Nebelwerfer 41*) 150-mm SP rocket projector, 10 barrels, 2 rows of 5 mounted on armored half-track (*15 cm Panzerwerfer 42*)	*15 cm Wurfgranate 41*					
	Spreng (HE)	36. 65	.....	HE	.....	8, 620
	Nebel (smoke)	40. 16	88	Sulphur trichloride absorbed in pumice	10 lbs	8, 366
	Gas	40. 16	.....	Y, G, Y, G1	.....	8, 500 (?)
210-mm 5-barreled rocket projector (*21 cm Nebelwerfer 42*)	*21 cm Wurfgranate 42*					
	Spreng (HE)	49	245	HE	.....	9, 675
	Gas (?)	.....	.....	.....	.....	.....

280- or 320-mm rocket projector, single wooden frame, or assembly of 4 (*28–32 cm schweres Wurfgerät 40*)	*28 cm Wurfkörper Spreng* (HE)	50. 75	183	HE		2, 440
280- or 320-mm rocket projector, metal frames (*28–32 cm schweres Wurfgerät 41*)	*32 cm Wurfkörper Flamm* (incendiary).	.....	174	Mixture of gasoline and Diesel oil	13 gals...	2, 430
280- or 320-mm SP rocket projector frames, 6 metal frames mounted at sides of half-track (*28–32 cm schweres Wurfrahmen 40*)						
280- or 320-mm SP rocket projector frames, 6 metal frames in 2 rows of 3 on 2-wheel tracks (*28–32 cm Nebelwerfer 41*)	Gas (?).....	.....	.....	.....	.....	.....
300-mm rocket projector, single wooden frame, perhaps also multibarreled projector (*30 cm Nebelwerfer 42*)	*30 cm Wurfkörper Spreng* (HE)	46	280	HE.....	.....	.....
	Gas (?).....	.....	.....	.....	.....	.....

Figure 3. German rocket weapons and projectiles for ground use in chemical warfare.

3. TROOPS.

a. Organization. (1) *Staff officers.* In all headquarters of the German Army down to battalions, or equivalent units, are a gas defense officer (*Gasabwehroffizier—Gab. O.*) and a gas equipment noncommissioned officer, who have been trained in protection. At army, possibly also at corps headquarters, is a staff officer for the Gas Defense Service (*Stabsoffizier für Gasabwehrsdienst Stogas*).[4] Not a General Staff officer but a member of the unit staff, he works with the operations section of the staff at army, corps, and division headquarters, and maintains liaison with the officer for weapons and equipment. Since the operations section would have control of any chemical troops attached to the unit, this officer probably would be concerned with their employment if offensive gas operations were undertaken.

(2) *Combat troops.* German chemical warfare (smoke) troops are a separate arm of the service under an Inspectorate of Smoke Troops and Gas Defense. Troop units normally form a part of GHQ reserve and are attached to tactical units for operations. Some divisions, however, may contain organic smoke troops.

Several types of chemical warfare, or smoke, troop units are known to be in service. There are smoke regiments and separate smoke battalions, as well as heavy smoke regiments which are equipped with rocket weapons. For defensive measures there are road decontamination battalions and decontamination battalions which can be converted into contamination battalions—depending, of course, on the immediate mission to be performed. (See figs. 4, 5, and 6.)

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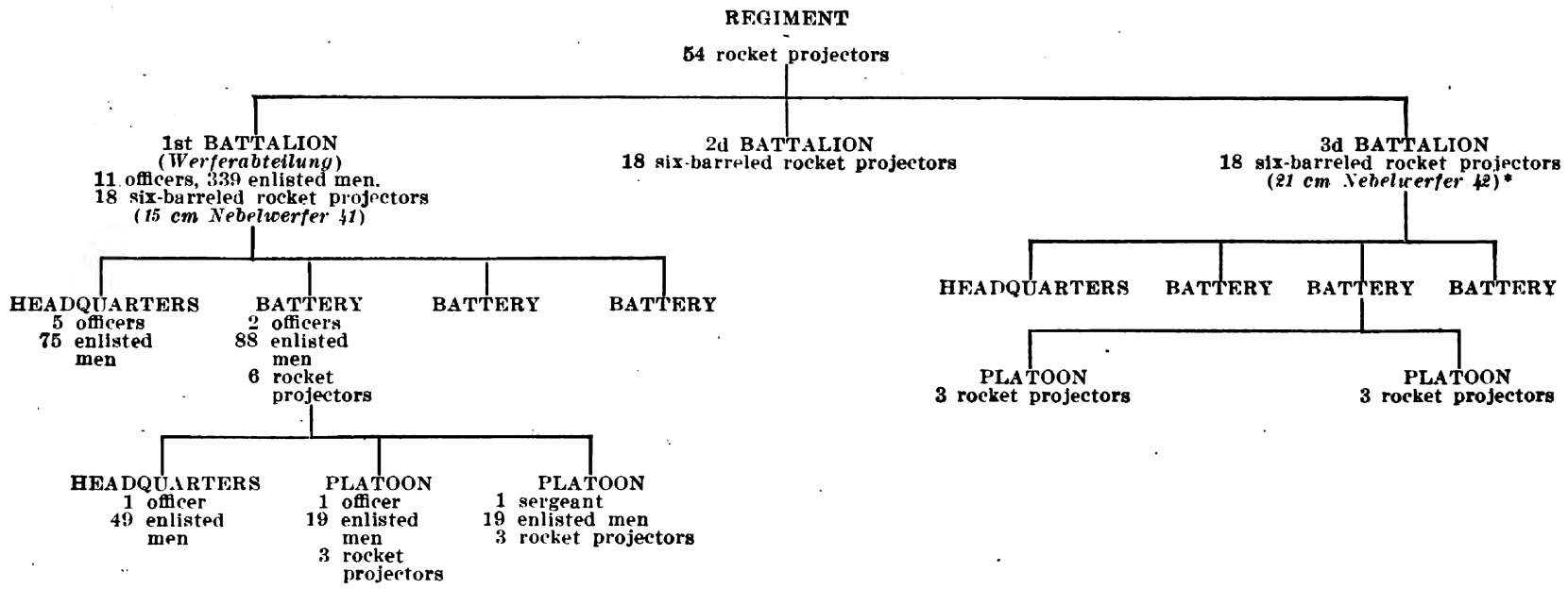
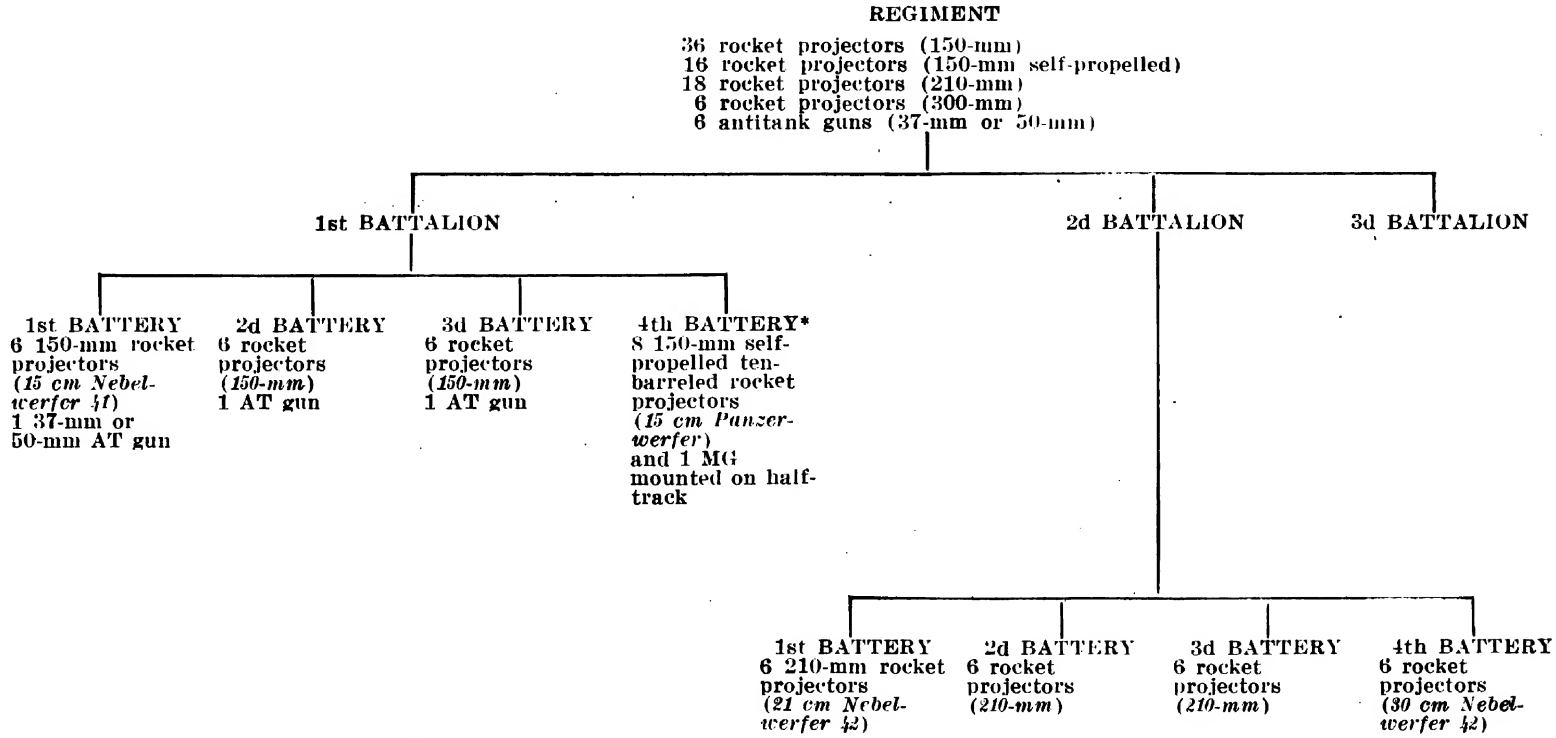
[4] The *Stogas* corresponds to the U. S. Army's Chemical Officer (on army, corps, or division special staff); the *Gab. O.* corresponds to the unit gas officer.



*In some regiments, 3d battalion has 150-mm projectors, as in 1st and 2d battalions.

Figure 4. Organization of the German chemical regiment (WERFERREGIMENT) equipped with 150-mm and 210-mm rocket projectors. (Probably most of the chemical regiments are now so equipped. In some cases, there are 4 rocket projectors to the platoon, a total for the regiment of 72 projectors.)



*This may be a separate battery attached for special operations or newly organized as an organic unit.

Figure 5. Organization of German armored projector regiment (PANZER WERFERREGIMENT).

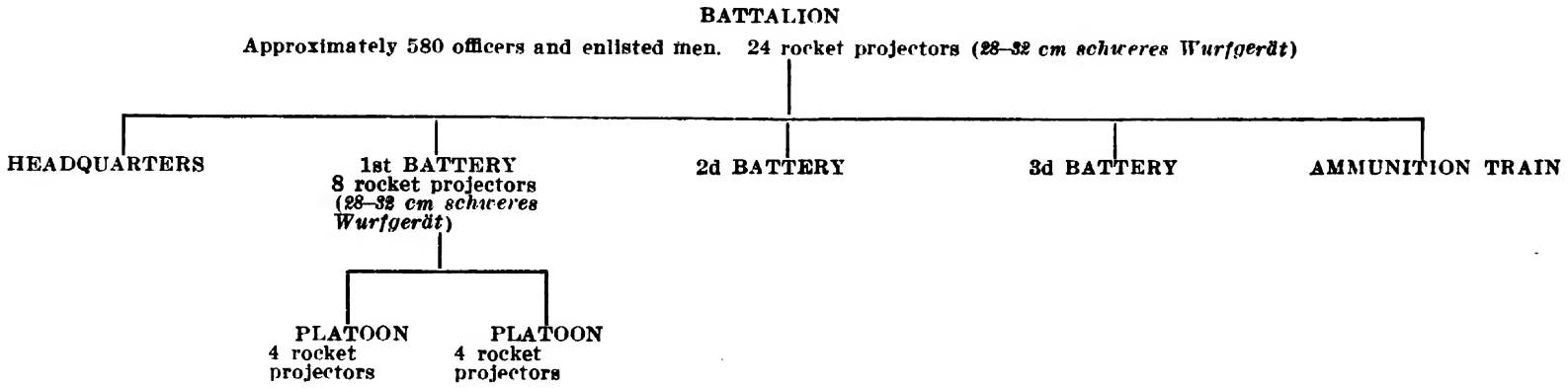


Figure 6. Organization of the German rocket projector battalion equipped with 280- and 320-mm rocket projectors. (This appears to be an independent battalion, attached as required.)

Recent reports indicate the presence in the field of armored (*Panzer*) smoke regiments of four battalions each. They are equipped with rocket projectors and are capable of dispersing enormous quantities of smoke or gas. Their organization is shown in figure 5.

b. Training. German officers and men are well trained in defense against gas. Training in unit and individual protection is given at numerous schools and at installations in the field where emphasis is laid on the correct fitting of gas masks and on proper breathing. Exercises in the performance of military tasks while wearing a mask are conducted. Identification of agents is stressed for all ranks; "smelling pots" and detonation tubes are used as training devices. Gas-chamber exercises are held regularly, and all men are trained in personal decontamination and in the wearing of protective clothing. Specialists are trained in identification and in the use of detectors; special care is taken with the selection and instruction of gas sentinels. The gas schools also teach the tactical employment of gas and smoke, presumably with the same care and thoroughness that they have devoted to personal and unit defense.

4. TACTICS.

a. Outline of German Doctrine. According to German doctrine the object of gas fire is to put the enemy out of action by destroying his combat efficiency, or to hinder his access to some tactically important areas.

The injurious effects of gas fire, the Germans state, extend beyond the radius of splinter and blast effect and persist considerably longer than those of explosive fire. There is also a powerful psychological effect, since it is difficult for the enemy to estimate the extent of the threat. If surprise is achieved, gas shells become effective before protective equipment can be adjusted.

The topography of the target and the weather conditions determine the effect of gas fire. The terrain at the target influences surface wind which regulates the action of the gas cloud. Favorable terrain includes thick undergrowth, depressions, woods, built-up areas, or places sheltered from the wind. In such sheltered places the force of the wind is reduced, and gas bombardment may be effective there even though, in the open, winds may rise to 6 to 10 meters per second (12 to 20 miles per hour). Marshes, damp ground, or hills are unfavorable for gas bombardment.

Favorable weather prevails when there is little or no wind, the sky is overcast, and the temperature is moderate (50 to 68 degrees Fahrenheit). These conditions, which prevail most often in the early morning or evening, are also occasionally encountered at night. Strong winds (more than 9 miles per hour), bright sunshine, frost, and heavy rain or falling snow are unfavorable for the employment of gas.

Wind direction and velocity, the nature of the terrain, the characteristics of the gas employed, and the normal dispersion of the weapons used deter-

mine whether a target near the front line can be engaged with gas ammunition without endangering friendly troops. The safety distance, using nonpersistent agents and considering the factors mentioned and the possibility of shorts is: 2,200 yards if there is a head wind, 1,100 yards for a quartering wind, and 325 yards in a tail wind. Because of effects downwind beyond the target area, salients as far as 2,200 yards away on the downwind flank must be taken into consideration. For persistent agents the margin of safety to be maintained for all wind direction is 325 yards.

b. Control of Gas Fire. Gas fire, which is a weapon of the higher command, is planned, as a rule, by the chiefs of the artillery command of divisions, or by corps staffs (*General Kommandos*). They determine, for all batteries, the targets, time of fire, rate of fire, type of ammunition, number of rounds, units of dispersion, and supply of ammunition. All these specifications are fixed after consideration of the peculiarities of individual targets, meteorological conditions, correlation with movements of friendly troops (the safety factor), synchronization with other troops or units involved in the action, and the availability of weapons for the shoot. All decisions are embodied in an artillery order and an ammunition order, which prescribe the necessary details for engaging on targets, methods of communication of the final weather report, types of ammunition, places of issue, observation of targets (from ground or air), ranging (if permitted), defensive actions of batteries in case of enemy attack, code words for beginning or ending of the fire, and other details not provided for in standing operating procedure. A high degree of centralized control is thus indicated.

c. Execution of Gas Fire. In carrying out a gas shoot the following principles are observed by the Germans:

Chemical agents are used only in large quantities to insure tactical success. Chemical ammunition is concentrated, therefore, only on an area strictly limited by the amount of ammunition available for the mission, and in a limited time. This does not apply when the mission is harassment.

Surprise in gas fire is of great importance, especially against a well-disciplined enemy who is provided with protective equipment. A change in the type of gas and in the method of placing during fire helps to secure surprise. Surprise is so important that in exceptional circumstances, even with unfavorable terrain and weather, gas should be fired if surprise can be attained.

Normally, however, the Germans employ gas only in favorable weather; the dispositions of troops that depend upon the use of gas are so made that they can be changed if unfavorable weather ensues. For this reason the meteorological service, which is a part of each gas battalion, is regarded as being of the utmost importance and it is required to furnish weather reports on the shortest notice to those responsible for firing gas.

In planning the use of toxic gases, the Germans always consider the safety of friendly troops, especially those on the flanks of the areas affected by gas fire.

d. Attack: Gas Cloud Fire. When the German use gas cloud fire against living targets, they try to produce as high a concentration of gas in the air as possible. The shell used for this type of fire is usually green-ring or blue-ring (that is, filled with a nonpersistent gas), seldom yellow ring (filled with a persistent gas).[5]

The Germans recognize four types of gas-cloud fire: surprise fire, neutralization fire, harassing fire, and the interpolation of gas shell among HE or smoke shell.

(1) *Surprise fire.* By surprise fire the Germans mean the establishment of a high concentration of a casualty-producing gas agent in the air over a selected area within 1 or 2 minutes. The gas normally used will be nonpersistent. The area must not exceed 12,000 square yards. Larger targets are divided into units of approximately 12,000 square yards and the guns of each battery are laid on a single point within the target area from which the gas will be dispersed over the target. Ranging is accomplished by the use of data from previous firing, by unobstrusive firing on the terrain with HE, or from map calculations. Firing smoke for ranging or to determine wind direction of the target is forbidden. It is expected that the first rounds from all weapons will register in the target area simultaneously. This necessitates the calculation of the time of flight of projectiles from different weapons and allowance for it in firing. Surprise fire is employed against occupied targets such as machine gun and artillery positions as well as troop units on the move or entrenched.

Ammunition requirements for surprise fire, as established by German doctrine, are given in figure 7.

(2) *Neutralization fire.* In German theory, neutralization fire of gas should begin with surprise fire, and should be continued for hours or even days. A high concentration is maintained to destroy personnel when gas discipline begins to collapse, or when canisters become saturated and the masks therefore cease to give protection. In open country, or if it is impracticable to maintain a high concentration continuously, neutralization may be effected by a series of surprise fires delivered at irregular intervals. This is done when the cloud is laid down by rocket projectors, because the rockets reveal the positions of batteries, which, therefore, must move to escape the effects of counterbattery fire. Alternating the types of fire, as well as changing the ammunition, is recommended to increase the neutralizing effect.

Neutralization fire may be employed when the wind does not exceed 9 miles per hour. After the initial surprise cloud has been laid down, the

[5] Gas cloud fire with nonpersistent gases is conceived generally as a phase of the attack, though it could be employed in defensive action. Contamination fire, on the other hand, as in U. S. doctrine, is regarded chiefly as defensive.

firing of occasional smoke shells is recommended to allow observation of the wind direction and of the movement of the gas cloud over the target. When the target is small, shells are placed directly upon it; when it is large, firing is directed toward observation and command posts from the upwind edge of the target.

Initial ammunition requirements for neutralization fire are the same as for surprise fire, for the first 1 or 2 minutes. Subsequently, the concentration is maintained with an equal amount of ammunition per target unit, but fired in 5 to 20 minutes, depending upon the amount of ground cover on the target. Detailed ammunition requirements are given in figure 7.

(3) *Harassing fire.* In German doctrine, harassing fire of war gases for several days preceding an attack with casualty-producing gas agents is recommended. An interval of 12 hours is prescribed between the cessation of harassing fire and the surprise casualty attack. Since low concentrations are sufficient for harassing effect the usual munitions are white-ring shells in quantities of 100 rounds for approximately 12,000 square yards during 24 hours. For ammunition requirements see figure 7.

(4) *Interpolation of gas shell with HE or smoke.* This variation of harassing fire is attained by the use of 10% to 25% of white-ring shell among the HE or smoke shell fired for other tactical reasons. German doctrine maintains that this harassing effect is valuable since it forces the enemy to mask and makes him apprehensive of more dangerous forms of gas attack. For ammunition requirements, see figure 7.

Neutralizing Fire—*Lähmungsschiessen*

Weapon	Shell used	Minimum number of rounds (Per 12,000 sq yd in a max of 2 mins)								Maximum rounds per min (long period by 1 btry of:)	
		For 50% dispersion zone length for the individual gun of:	Wind velocity								
			2.2 mph		4.4 mph		6.6 mph		8.8 mph		
			Open country	Covered terrain	Open country	Covered terrain	Open country	Covered terrain	Open country	Covered terrain	8 guns	6 guns
105-mm smoke mort 35.	Yellow ring*.....	.....	2–4	1–2	4–8	2–4	6–12	3– 6	8–16	4– 8	24	18
105-mm smoke mort 40.	Yellow ring*.....	.....	3–6	2–4	6–12	4–8	9–18	6–12	12–24	8–16	24	18
150-mm rocket projector 41.**	Green ring yellow* green ring 1.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
105-mm lt fld how.....	Green ring, green ring yellow, or yellow ring*..	Less than 50 yds.	2–3	1–2	3– 6	2–3	5– 9	3– 5	6–12	3– 6	12–14	.....
		50–100 yds.....	3–6	2–3	6–12	3–6	9–18	5– 9	12–24	6–12	.....	.....
150-mm medium fld how or 150-mm hv inf how.	Green ring, green ring yellow, or yellow ring.*	Less than 50 yds.	½–1	¼–½	1– 2	½–1	2– 3	1– 2	2– 4	1– 2	6– 8	.....
		50–100 yds.....	1–2	½–1	2– 4	1–2	3– 6	2– 3	4– 8	2– 4	.....	.....

*Only if the locality will not be crossed by German troops.
**Neutralizing fire can only be produced by the 150-mm rocket projector through the use of repeated gas fire.

606251°—44——3

Gas Surprise Fire—*Gasüberfall*

Weapon	Shell used	Minimum number of rounds (per 12,000 sq yd in a maximum of 2 mins with a wind velocity of)				Maximum number of rounds per min (over a short period of 1 btry of)		Area covered by 1 btry in 1 min	
		2.2 mph	4.4 mph	6.6 mph	8.8 mph	8 guns	6 guns	8 guns	6 guns
105-mm smoke mort 35	Yellow ring	20	40	60	80	96	60	57, 600	43, 200
105-mm smoke mort 40	Yellow ring	25	50	75	100	80	60	31, 200	24, 000
150-mm rocket projector 41	Green ring yellow, yellow ring 1.	5	10	15	20	48	36	115, 200	86, 400
105-mm lt fld how	Green ring	*15	*30	*45	*60	24	.....	19, 200	.....
150-mm medium fld how or hv inf how	Green ring yellow	*5	*10	*15	*20	20	.....	48, 000	.....

*For a 50% dispersion of less than 50 yards. For a 50% dispersion of 50–100 yards double the number of rounds.

Figure 7. Ammunition requirements for gas cloud fire.

Harassing Fire—*Ermüdungsschiessen* (for several days before gas surprise fire)

Weapon	Shell used	Minimum number of shells for 12,000 sq yd for a wind of less than 9 miles per hour**	
		Temperature about 50° F	Temperature below 50° F
80-mm inf mort	White ring	200 in 24 hours	200 in 24 hours
105-mm lt fld how 150-mm medium fld how 75-mm lt inf how	White ring	100 in 24 hours	200 in 24 hours
Interpolation of gas shell in HE, or better, in smoke fire			
80-mm inf mort 105-mm lt fld how 150-mm medium fld how 150-mm hv inf how	White ring	From 10% to 25% of the HE or smoke ammunition.	From 10% to 25% of the HE or smoke ammunition.

**For each 2-mph wind velocity above 9 mph, increase by 25%.

Figure 7.—Ammunition requirements for gas cloud fire—Continued.

(5) *Calculation of ammunition requirements.* The basis of German calculations of ammunition requirements for gas-cloud fire is the hectare, an area 100 meters square (approximately 12,000 square yards). It corresponds to the square (10,000 square yards) which is used by U. S. chemical weapons units for similar calculations. The ammunition required for gas-cloud fire is the number of shells which, fired in one minute on an area of 12,000 square yards in a wind of 2.2 miles per hour, will produce a concentration in the air of 100 milligrams per cubic meter (0.1 ounces per 1,000 cubic feet) to the height of about 16 feet. These requirements are calculated on the basis of a 50% dispersion zone less than 50 yards long. This is an effective casualty concentration. A lethal concentration, with green-ring or green-ring-yellow shell, that will be effective against unprotected troops in 1 minute must be 10 times this strength. It can be achieved only under most favorable conditions, with dispersion less than 50 yards in length and wind less than 2.2 miles per hour.

The ammunition requirements of weapons normally expected to be used for gas-cloud fire are given in figure 7.

e. Defense: Bombardment for Contamination. (1) *Purpose.* The Germans employ ground contamination primarily as an accompaniment of defensive action. Its purpose is to lay down persistent gas upon ground tactically important to the enemy to such an extent that he will be hindered in traversing it, delayed by the necessity for decontamination, or subject to losses if he fails to recognize the presence of gas and passes through the area. Contamination of terrain may be effected by shell fire, the use of spray vehicles, or chemical mines. The Germans may also try to achieve this effect against targets which are under cover, and against permanent defenses which can be isolated by the contamination of terrain around them. Suitable targets are concentrations of reserves, command posts, firing positions, lines of departure, defiles and shelters, and targets whose precise positions are not known. Favorable opportunities for use of contamination fire usually occur in defense and during withdrawal, but this fire seldom can be used in attack, and then only if the area affected will not be involved in the attack or if it is an enemy strongpoint that may be by-passed.

The effects of contamination persist in spite of weather and terrain; yellow-ring ammunition persists for 12 to 24 hours, double yellow-ring for 48 to 60 hours. If contamination is to be maintained for longer periods it must be reinforced from time to time.

(2) *Types.* Three types of ground contamination are recommended by the Germans: harassing contamination, which can be laid down quickly to confuse and delay the enemy; blockading contamination; and sham contamination.

Blockading contamination is laid down carefully and in density sufficient to cause the enemy to stop for decontamination or to accept casualties as a result of crossing the affected terrain. The blockade consists of a thick closely connected network of points and strips of land that have been given concentrated contamination, and it is effective only if the area covered is large. German doctrine points out that contaminated terrain alone does not make a strong belt of defense. It should be strengthened by obstacles to prevent the passage of armored vehicles or tanks. Moreover, like other obstacles, contaminated ground must be covered by aimed fire. Combat outposts therefore must be pushed well forward into the contaminated zone to prevent enemy attempts to decontaminate terrain or to traverse it. Such forces may proceed through paths left free of contamination for their use, or, if protected by light antigas clothing, they may proceed directly into the area to their positions.

Sham contamination, or the use of simulated agents, is employed to confuse and puzzle the enemy. Its effect is intensified if some spots of real gas are interpolated into the affected area. Friendly troops, of course, cross sham contamination without hesitating.

Supervision and observation of ground-contamination operations are carried out by specially trained "detonator troops." They man the outposts to cover the barrier, guide friendly troops through the contamination paths, and remain behind to detonate the mines that close these paths after friendly troops have passed through.

(3) *Capabilities.* The capability of the contamination company[6] is estimated on the basis of a standard contamination of 100 grams per square meter (0.32 ounce per square foot), 10 times the concentration set up as an objective for contamination fire by mortars or artillery. The 12 medium spray vehicles of the contamination company are able to produce this standard blockading contamination to the extent indicated below:

Terrain	One vehicle	Platoon (6 vehicles)	Company (12 vehicles)
Strips 39 feet wide	0.6 miles	3.7 miles	7.5 miles.
Strips 98 feet wide	0.25 miles	1.5 miles	3.0 miles.
Area	3 acres	18 acres	36 acres.

The speed of spraying vehicles varies with the width of the strip to be contaminated. At 2 miles per hour, a vehicle sprays a strip 50 feet wide; at 7.5 miles per hour, 13 feet wide. An average speed of 5.6 miles per

[6] Contamination companies are apparently the same as decontamination companies.

hour allows spraying of a strip 20 feet wide. Spray nozzles are mounted on long adjustable arms to cover various widths.

For purposes of comparison, an airplane can produce a contamination of 8 to 9 grams per square meter (.026 ounce per square foot) with spray tanks, and 30 grams per square meter (0.1 ounce per square foot) by chemical bombs. However, area contamination by airplanes is not regarded by the Germans as economical or satisfactory.

One chemical land mine covers an area of 215 to 270 square feet. Eighty-one mines (*Sprühbüchsen 37*) are required to produce a concentration of 100 grams per square meter (0.32 ounce per square foot) over 12,000 square yards (2.5 acres). The interval between mines and between rows is 36 feet. A contamination company, then, which is provided with 200 mines, can lay down a blockading concentration over an area of 6 acres.

(4) *Technique of fire.* German doctrine requires that no "holes" should be left in the contamination blanket. A strip of target is assigned to each battery to be covered by its guns firing parallel. Extensive areas may be dealt with in sections by a few batteries firing over a long period at a rate of fire determined by the circumstances. Observation of fire is important to insure equal distribution of rounds over the target. Other types of shells with similar ballistic qualities may be fired if needed for ranging and observation, and if the bursts of the yellow-ring shells are not clearly discernible. Corrected map fire may be employed, but a straight map shoot should be resorted to only if accurate data are available and no observation is possible.

Major ground contamination missions are undertaken by contamination companies (motorized) in terrain not held by the enemy and not under observed enemy fire. Each contamination company is equipped with 12 medium spray vehicles, of 1⅓-tons capacity, and carries 200 chemical mines (*Sprühbüchsen 37*). Both vehicles and mines presumably disseminate persistent blister gas, although in some situations moderately persistent gas may be used. Vehicles are used to lay broad belts of contamination of considerable depth; mines are used in places not accessible to the vehicles, such as houses, dugouts, and barriers.

(5) *Calculation of ammunition requirements.* The amount of ground contamination attainable per square yard does not vary with the caliber of shells, since larger shells produce large, heavily contaminated craters spaced relatively widely, while smaller shells cause more numerous, small contaminated spots and spread contamination more evenly over the target. German theory, therefore, favors ground contamination with smaller-caliber shells.

The unit for the calculation of ammunition requirements for ground contamination, as it is for cloud gas, is 12,000 square yards. A concentra-

tion of 10 grams per square meter (0.032 ounce per square foot) may be built up by the various weapons as shown below:

Weapons [1]	Rounds per 12,000 square yards
105-mm smoke mortar	100
105-mm smoke mortar 40	300
105-mm light field howitzer	100
150-mm medium field howitzer	35

[1] Infantry weapons are not used for ground contamination.

These requirements apply to covered terrain, such as woods or built-up areas. In open country they must be approximately doubled. For contaminations higher than the standard 10 grams per square meter (0.032 ounce per square foot), proportionate increases must be made.

f. Dispersion of Gas by Airplanes. Gas may be dispersed from airplanes or in bombs. Low-pressure or gravity spray tanks could be fitted to most German airplanes (smoke spray devices will also spray toxic gas), and gas bombs could, of course, be dropped by bombers. Figures 8 and 9 give data on spray tanks and bombs.

German doctrine of the use of spray seems to favor low-altitude spray to the exclusion of high-altitude mist, apparently in the belief that it is the only effective weapon of this type. This doctrine also stresses the importance of spraying living targets, and at the same time attacking with machine guns and high-explosive bombs. Targets mentioned are "troops marching or bivouacking, or congested in front of defiles or at rivers," but not troops deployed over battlefields in small groups. The attack is to be made at low altitude and is to take the enemy by surprise. "The *Luftwaffe* can either support the ground fighting directly or operate over the enemy's back areas beyond the range of the smoke troops and of the artillery."

Bombs may be used to produce local ground contamination; air-burst bombs, over personnel beyond the range of mortar or artillery fire, produce results similar to those of spray attacks.

Designation and type	Total weight (pounds)	Body diameter (inches)	Overall length (inches)	Filling and weight (pounds)
B 1 E incendiary	2. 2	2	13. 5	Thermite: 0.434.
B 1 E Z incendiary [1]	2. 2	2	13. 5	Thermite: 0.434.
B 1 E ZB incendiary [2]	2. 6	2	13. 5	Thermite: 0.434.
B 1.3 E incendiary	2. 9	2	13. 5	Thermite: 0.434.
B 1.3 E Z incendiary [1]	2. 9	2	13. 5	Thermite: 0.434.
B 2 E Z incendiary [3]	4. 4	2	20. 7	Thermite: 0.434.
B 2.2 E Z incendiary [4]	4. 8	2	20. 7	Thermite: 0.434 HE: 0.22.
GC 10 gas	26	3. 25	23	Blue-cross gas.
(12 kg) incendiary	26. 4	6. 50	23. 50	Thermite.
BSK 36 incendiary bomb container.	.....	8	43	Holds 36 *B1E* or 16 *B2EZ* or *B2.2EZ* incendiary bombs.
AB 36 incendiary bomb container.	.....	9. 3	44. 5	Holds 36 *B1E* or 24 *B2EZ* or 24 *B2.2EZ* incendiary bombs.
AB 42 incendiary bomb container.	.....	.....	.....	Holds 42 *B1E* incendiary bombs.
Sprengbrand C50 (34 kg) incendiary bomb container.	75	8	43. 2	TNT 13.23 lbs: 6 2.3-lbs Thermite pots. 67 2.4-oz Thermite pots.
Brand C 50 A (45 kg) incendiary.	99	8	43. 2	15.9 quarts of mix: Benzene, 86%. Rubber, 10%. Phosphorus, 4%.
Brand C 50 B incendiary	77	8	43. 2	Same as above.
SC Type (50 kg) incendiary	90	8	.....	30 lbs. Smoke mixture: Benzene, 86%. Rubber, 10%. Phosphorus, 4%.
NC 50 smoke	110(?)	8	43.3	Smoke mixture: Hexachlorethane, 91%. Aluminum, 8.5%. Iron oxide& silica, 0.4%.
NC 50 W–C (for use on water) smoke.	110(?)	7.75	43	Smoke mixture probably same as *NC 50*.
GC 50 gas	66	8	43.2	42 lbs yellow-cross gas.
Flam C 250 incendiary	242	14.5	64.4	110 lbs crude oil, aluminum, magnesium powder, wood meal-petrol ignition.
Flam C 250 B *Flam C 250 C* Incendiaries	.....	14.5	64.2	Crude oil, aluminum, magnesium powder, ignition.
Brand C 250 A incendiary	.....	14.5	64.5	76.3 quarts mixture: Petroleum solvent, 87.7%. Polystyrene, 11.7%. Phosphorus, 0.5%.
NC 250 S smoke	242	14.5	63	Smoke mixture: Chlorsulphonic acid, 40%. Sulphur trioxide, 60%.

[1] Explosive charge in base of bomb below tail.

[2] Explosive charge in head of fuze detonates ½–5 min. after impact due to heat produced by burning casing.

[3] Fuze contains powder charge which blows off HE attachment which then detonates after a delay of ½–8 minutes.

[4] The HE nose may become detached and will detonate ½–6 minutes after impact.

Figure 8. German bombs filled with gas, smoke, or incendiary agents.

Designation and type	Total weight (pounds)	Body diameter (inches)	Overall length (inches)	Filling and weight (pounds)
KC 250 GB gas	242	14.5	63	110 lbs yellow-cross gas.
BSB 320 incendiary bomb container.	.....	20.0	93	Holds 320 *B1E* incendiary bombs. Container not dropped.
Flam C *500* (200 kg) incendiary	440	19.0	70.1	220.5 lbs crude oil aluminum magnesium powder ignition.
Flam C 500 C (210 kg) incendiary.	462	19.0	70.1	220.5 lbs of mix: crude oil, aluminum, Mg-powder ignition.
AB 500–1 incendiary bomb container.	1, 034	19.0	80	Holds 184 B1.3 EZ or 116 B2 EZ bombs.
ABB 500 incendiary bomb container.	1, 102 (?)	18.6	69.0	Holds 133 B1E and 7 B1EZ or 75 B1E and 58 B1.3 E and 7 B1.3 EZ.
500 Kg incendiary	1, 102	.....	.....	Phosphorus.
Streubrand C 500 incendiary container.	1, 100 (?)	.....	.....	Holds 1,400 "firepots".
KC 500 Gas	462	18	65.5	200 lbs green-cross gas.
BSB 700 incendiary bomb container.	1, 995 or 2, 457	26	121	Holds approximately 700 B1E or 700 B1.3E bombs. Container not dropped.
BSB 1000	.....	24	100	Holds approximately 620 B1E incendiary bombs. Container not dropped.
AB 1000–2 incendiary bomb container.	2, 200 (?)	26	123	Holds 620 B1E or 372 B2EZ bombs.

Figure 8. German bombs filled with gas, smoke, or incendiary agents—Continued.

Type of spray apparatus	SN 40	SN 50	Fuma L 90 (Czech)	S 125*	Fuma L 190 (Czech)	S200/V or S200/VI	S200/VI	S300
Agent used	Smoke Gas?	Smoke Gas?	Smoke Gas	Smoke Gas?	Smoke Gas	Smoke Gas?	Smoke Gas?	Smoke Gas?
Employment	Sea	Sea				Sea	Sea & land	Sea & land.
Aircraft type: Number per aircraft, suspended from or mounted on.	He 60: 1 spray tank, 4 containers (mounted) in float.	He 114: 1 spray tank, 2 containers (attached) in float.				He 59: Up to 3 tanks adjacent. PVC 505	He 45: 1 tank MRC 250. Hs 126: 1 tank EHVC 500.	He 115: 1 tank PVC 1006A. He 111–H4: 2 tanks PVC 1006L. DO–217: (3) tanks Bomb bay.
Weight (lb):						Large filling (each tank)	Small filling (each tank)	(Per tank).
Empty	114 lbs	55 lbs	97 lbs		132 lbs	139 lbs	139 lbs	286 lbs.
Filling	282 lbs	220 lbs	343 lbs		748 lbs	660 lbs	418 lbs	1,100 lbs.
Total	396 lbs	275 lbs	440 lbs		880 lbs	799 lbs	557 lbs	1,386 lbs.
Filling (gals)	17	13	23.8	10.5	50.2	39	25	65 gals per tank.
Smoke cloud:								
Height	130–165 ft	130–165 ft				130–165 ft	130–165 ft	130–165 ft.
Length	about 2 mi	about 1½ mi		1.9 mi (?)		about 5–6 mi	about 4 mi	9–11 mi.
Time	1 min	¾ min				3 mins	2 mins	3 mins.
1 barrel (31 gals) of smoke fills:	2	2⅓				4/5 S200/V or S200/VI.	1¼ S200/VI	½ S300.

*The S100 is also known to exist.

Figure 9. German airplane spray tanks for smoke screen use. (It is believed that they can also be used for the spraying of gas.)

Section II. SMOKE

5. USE OF SMOKE BY GROUND TROOPS. a. German Doctrine in the Employment of Smoke. The German doctrine of the use of smoke by ground forces may be summarized as follows: Smoke is a weapon of opportunity. It aids in determining ranges and locations and serves to deny observation to the enemy; to deceive him; to interfere with the accuracy of his aimed fire; and to cause him to waste ammunition. The defense will avoid the use of smoke because it reduces visibility;[1] the attacker will employ it to reduce the accuracy of defense fire.

The Germans state that artificial smoke may be used to conceal their own movements with smoke from candles or cylinders in or near their own lines; or to blind the enemy by smoke placed around or ahead of him, by mortar or artillery shells, or, if the distance is short and the wind favorable, by candles or grenades. A smoke screen on the enemy is always more effective than a smoke screen on friendly troops because it blinds him or limits his observation to a short distance. It is also used to deceive the enemy and draw his fire or to divert his attention. Diversion smoke screens are successful only when they are not recognized as such, and are used immediately before or simultaneously with tactical smoke screens.

b. Weapons and Ammunition. Smoke ammunition is available for the weapons of the *Nebeltruppen,* for mortars and rocket projectors, for the 75-mm assault gun, and for the artillery and infantry howitzers of various calibers. Details are given in figures 1, 2, and 3.

The Germans distinguish between two kinds of artificial smoke (*Künstlichen Nebel*), known as *Nebel* (mist) and *Rauch* (smoke). *Nebel* consists of liquid particles formed by the condensation of moisture in the air upon the hygroscopic particles of the smoke-forming substance; it therefore resembles natural mist. *Rauch,* on the other hand, is a product of combustion or destructive distillation; the particles are either solid or tarry as in ordinary smoke from fire. Both accomplish similar tactical purposes. However, *Nebel* (mist-forming) substances need only be disseminated in the air, while *Rauch* (smoke) requires a starting fire and continued heat, the distinction is useful for identification both of the smoke-producing agents themselves and of the method of dispersion. *Nebel* ammunition may be fired from a distance; *Rauch* munitions usually are ignited at or near the point of emission. German static munitions include smoke pots, smoke hand grenades, and frangible smoke hand grenades.

A report from Italy states that about 90% of German smoke shells are believed to be filled with the equivalent of U. S. FS smoke (sulphur trioxide, in chlorsulphonic acid mixture) and 10% with white phosphorus,

[1] Nevertheless, there is evidence that the Germans use smoke defensively, placing it upon enemy observation posts and gun positions.

which is used for harassing fire rather than for smoke operations. The use of white phosphorus (WP), it is reported, was begun about December 1943 and has become increasingly frequent. For smoke within their own lines the Germans apparently rely on smoke pots.

The Germans also have a number of smoke signaling devices that are not, strictly speaking, ammunition. Among them are the various hand smoke signals, which are available in red, orange, green-blue, and violet, and several colored smoke signals to be dropped from airplanes. For the 27-mm combat signal pistol are provided smoke cartridges, smoke indicator cartridges which give off a red-brown puff of smoke, and blue or violet smoke cluster cartridges. A message container, with a yellow smoke tracer, exists; it is designed to hold messages dropped from airplanes to ground troops.

c. Smoke Troops. Smoke is fired by the regular German chemical warfare troops (*Nebeltruppen*), equipped with smoke mortars and rocket projectors, and capable of laying and maintaining large smoke screens for considerable periods. Their organization has been described above (paragraph 3a (2)). Smoke munitions are available also to artillery, infantry, armored units, and engineers. Engineers, particularly, carry large supplies of smoke materiel on the bases shown in the accompanying table (fig. 10).

Unit	Smoke grenades (*Nebelhand-granaten*)	Smoke pots (*Rauchröhren*)	Smoke pots (*Nebelkerzen*)
Infantry Division:			
Engr Co	135	36	36
Engr Co (mech)	135	36	36
Lt Engr Clm (mech)	225	150	108
Lt Engr Clm	135	150	24
Engr Cyclist Co	135	36	36
Motorized Division:			
1 Co (mech)	135	36	36
2 Co (mech)	135	36	36
3 Co (mech)	135	36	36
Lt Engr Clm (mech)	225	150	108
Armored Division:			
Lt Engr Co (mech)	135	36	36
Armd Engr Co	135	36	108
Engr Co (armd)	135	36	36
Lt Engr Clm (mech)	225	100	108
Mountain Division:			
1 Mtn Engr Co	135	36	36
2 Mtn Engr Co	135	36	36
3 Lt Engr Co (mech)	135	36	36
Lt Mtn Engr Clm (mech)	225	150	108

Figure 10. Scale of issue of smoke equipment to engineer units.

d. Smoke in Attack. The German doctrine of the employment of smoke in attack, stated above (par. 5a) stipulates the use of smoke for two main purposes: to screen the movements of friendly troops, and to interfere with enemy observation or fire. It is illustrated and explained in the following examples and accompanying diagrams derived from German manuals. A key to the symbols used is given in figure 11.

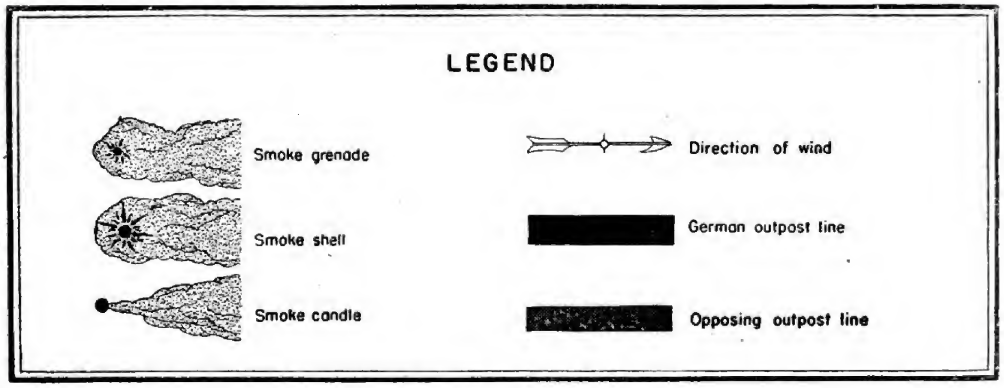


Figure 11. Key to German symbols used in tactical diagrams.

(1) *To blind flanking fire.* Figure 12 shows the placing of smoke on an enemy heavy machine-gun position to obscure the enemy's vision and allow the attack to proceed.

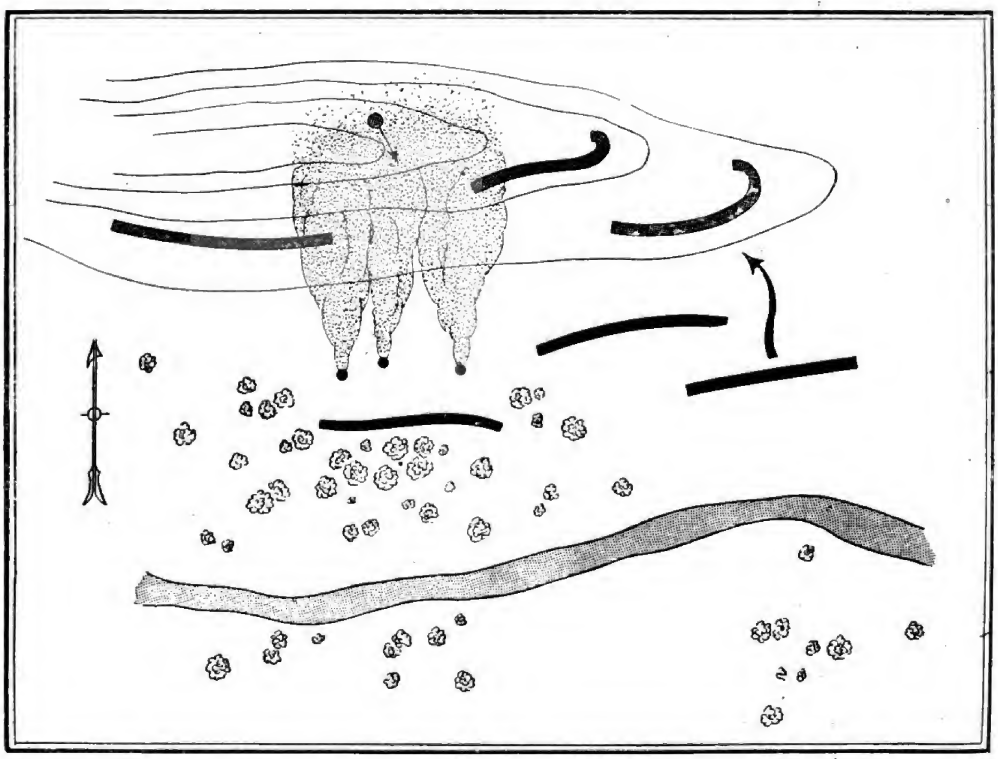


Figure 12. The use of smoke to blind flanking fire.

(2) *To assault machine-gun emplacements.* In figure 13, wire barricades exist in front of the enemy machine-gun positions. Lanes are cut under cover of smoke. (In prolonged activity in dense smoke clouds the gas mask is put on.) The screen is extended forward by smoke troops, using smoke candles since the wind direction is favorable. Both flanks of the nest are attacked under a light smoke screen, and a few smoke grenades are thrown in front of and into the nest.

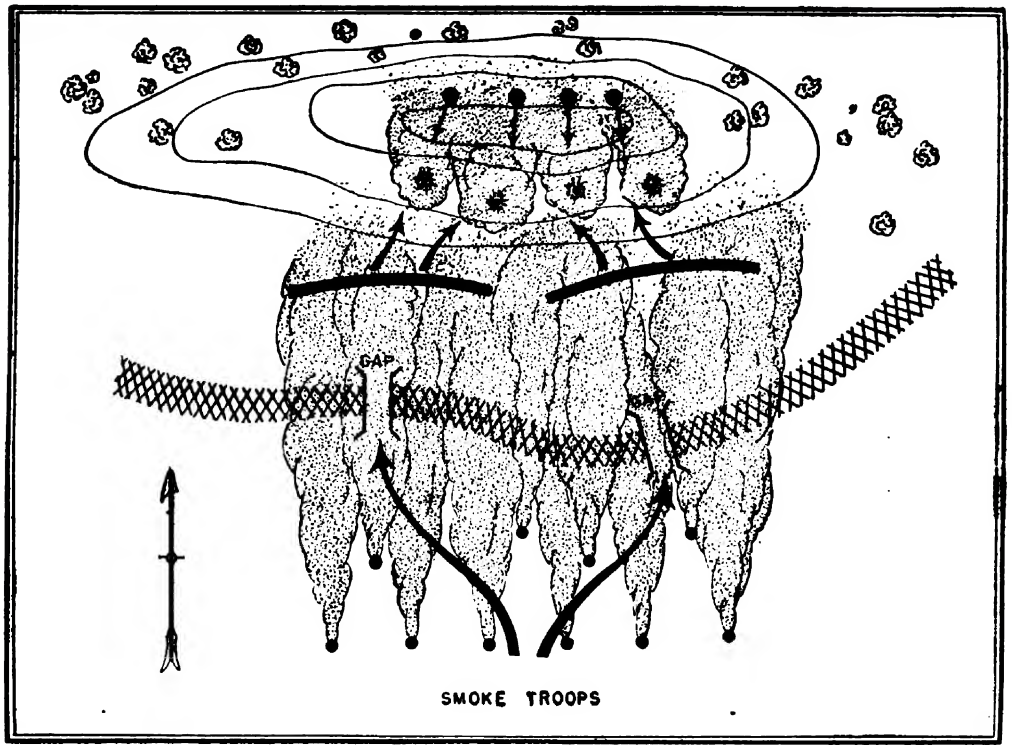


Figure 13. The use of smoke in an assault on machine-gun emplacements.

(3) *To assault a pillbox.* The technique is similar to that employed against machine-gun emplacements, with some interesting modifications. The assault is preceded usually by an artillery concentration, one purpose of which is to make craters to serve as cover for an advancing combat engineer detachment. When the assault detachment reaches wire barricades surrounding the pillboxes, a Very signal calls for all available artillery fire to be concentrated on the pillbox, and smoke screens are laid down by grenades or candles. Men with wire-cutters or bangalore torpedoes open lanes through the wires. Very signals then call for a cessation of artillery fire against the pillbox, and a flame-throwing detachment, covered by accompanying machine-gun fire, advances through the lanes in the wire and attempts to get within five or six yards of the pillbox. When the flame throwers have nearly exhausted their fuel, they shout a warning; and men with bangalore torpedoes advance to the embrasures and detonate their charges therein. (The charges are said to be effective even if

embrasures are closed.) If the pillbox still holds out, smoke candles are thrown in to make the air unbreathable, or an attempt is made to blow in the roof with a heavy charge.

(4) *To attack with tanks.* To cover an attack by tanks, hostile observation is blinded by smoke laid by airplanes, while artillery blankets hostile antitank weapons (see fig. 14).[2]

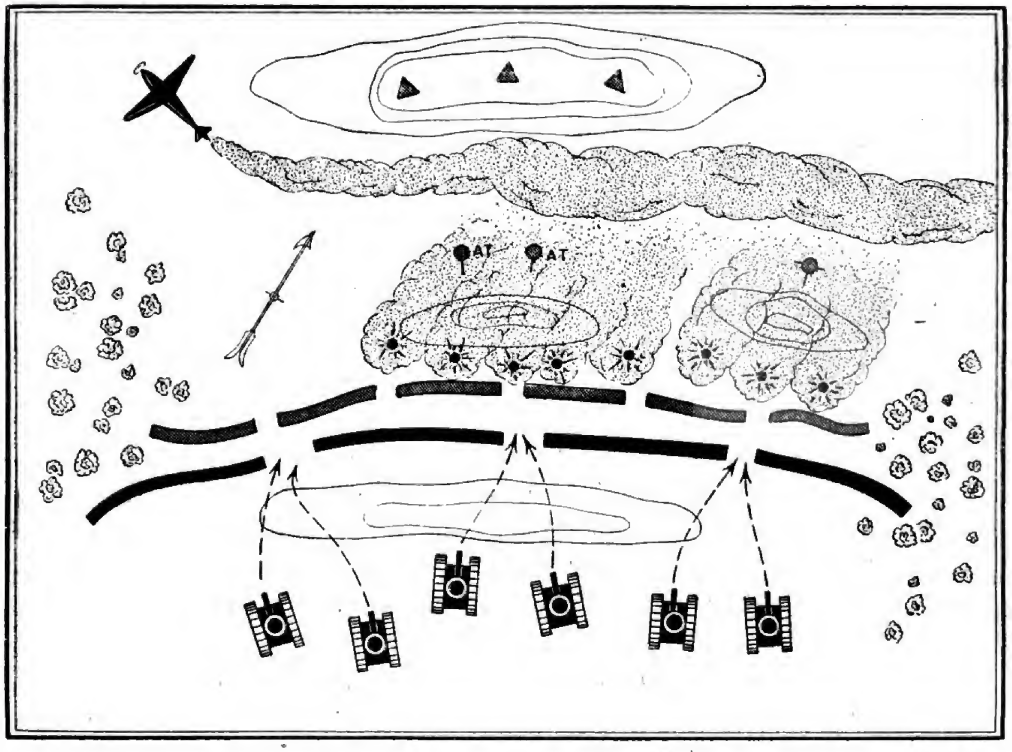


Figure 14. The use of smoke to cover an attack by tanks.

(5) *To enevelop an enemy strongpoint.* An enemy strongpoint may be covered by smoke during a flanking or enveloping attack. Observation posts in the area must also be blinded. Figure 15 shows an illustration of this operation.

(6) *Examples of German use of smoke in attack.* The following account of the actual use of smoke in attacks by the Germans early in 1944 is quoted from an American observer's report:

> On Monday afternoon, 28 February, the Germans set up a smoke screen about 4 miles long and maintained this screen from 1630 until dark. The wind was favorable and under cover of this screen, which was blowing parallel to our lines, the Germans rearranged many of their troop units and displaced their artillery preparatory to a push the following morning.

[2] It seems likely that smoke troops, if available, rather than artillery would be used for this mission.

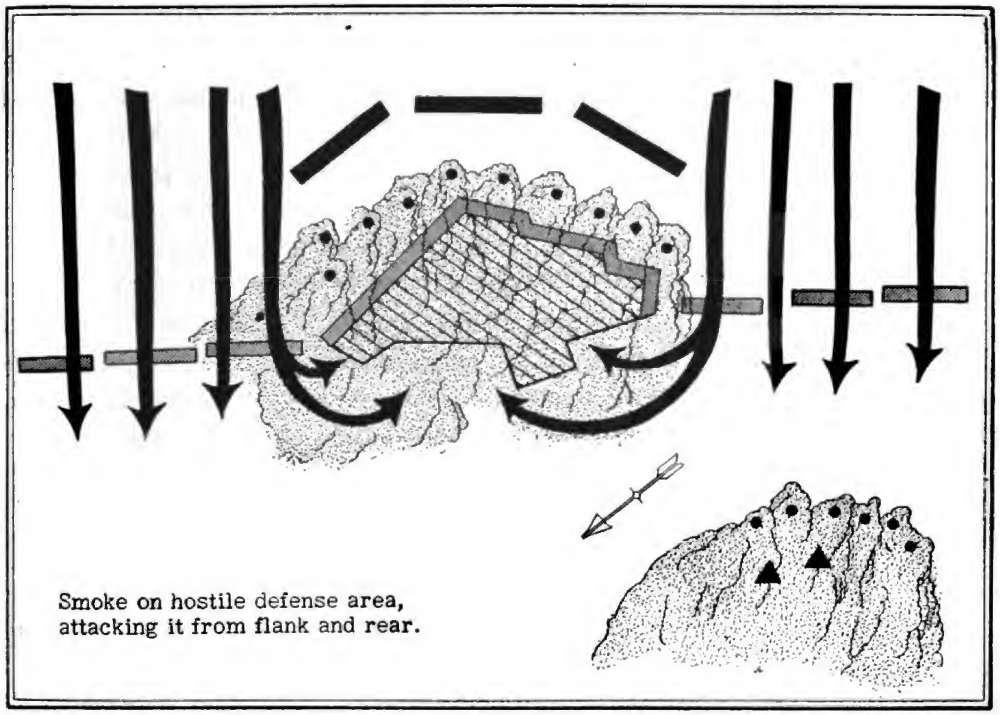


Figure 15. The use of smoke to envelop an enemy strongpoint.

On Tuesday morning, the 29th, I witnessed the use of a smoke screen on the Anzio beachhead covering a German attack. The smoke was laid with a 12:00 o'clock wind blowing in the face of the attackers. The screen was placed well back of our front lines on our main support position and in the cool damp air of the early morning this smoke cloud settled down to a solid bank which moved across the level fields over our front lines but was fairly well dissipated by the time it reached the Germans.

From their high observation points in the mountains to the rear, they were able to see over this cloud and so direct their artillery fire against specific targets while at the same time our view and observation were cut off completely over that entire front. Their attack succeeded in making a considerable dent in our lines which was more than straightened out that night when the infantry counter-attacked under cover of our own smoke screen and air bombardment. . . .

Small units who are going to make a night attack almost invariably set up a smoke screen about one-half hour before darkness and move back of the smoke screen into their new attack positions. Also this use of smoke screens occurs frequently when no attack is intended. This is done simply to harass the front line units into making all kinds of preparation against an attack which is never intended. . . .

The foregoing technique of employment of smoke appears to be practically standard as it has been used in exactly the same way both on the Anzio beachhead front as well as on the Cassino front.

It is known that the Germans have made use of smoke troops (*Nebeltruppen*) firing the 150-mm rocket projector (*15 cm Nebelwerfer 41*) in Italy. For a screen as extensive as the 4-mile screen described, the rocket

projector, which has six rocket tubes and a high rate of fire, was almost certainly the weapon used. An artillery concentration of unusual proportions would be required to undertake a smoke mission of this size.

(7) *Attack under cover of area smoke.* A specialized German operation involving the use of smoke in enormous quantities and in close coordination with the movement of infantry is the attack under cover of area smoke. Although no evidence is available to show that this exact maneuver has been employed, it is described in a German manual, *Der Angriff unter Einsatz von Flächennebel,* as an attack upon a fortified position, and is conceived as an offensive operation. The object of the smoke operation is to maneuver troops in an assault on the enemy position under cover of smoke, thus upsetting the coordination and aim of enemy

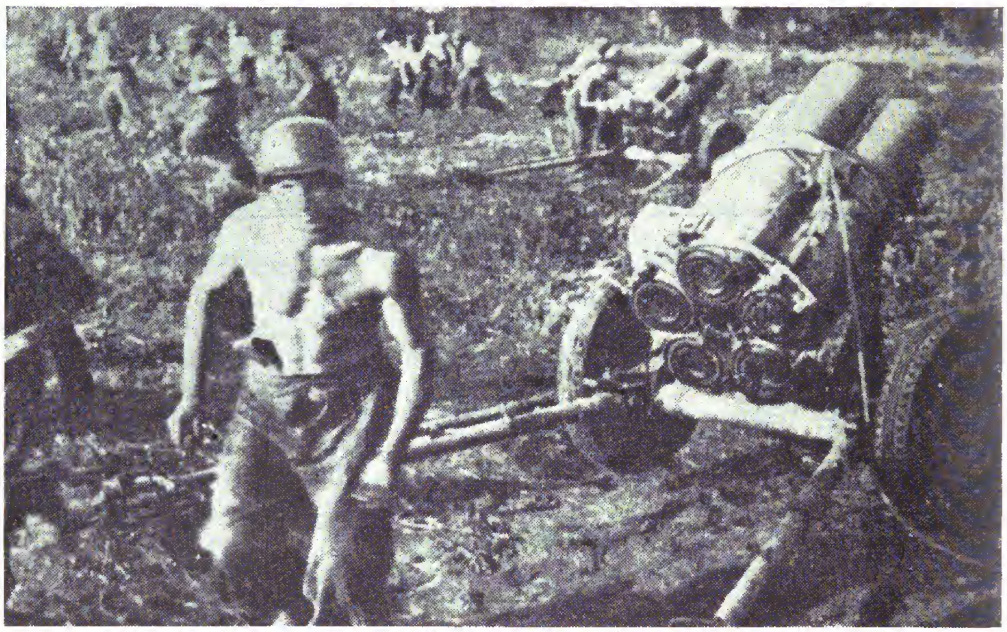


Figure 16. The German five barreled 21 cm Nebelwerfer 42.

fire. The attacking force advances through smoke, which has been laid over an extensive area—a division or regimental sector—penetrating en route the main enemy defensive positions. Then they pass out of the smoke covered zone and seek to exploit their breakthrough by quickly capturing artillery positions in the rear behind the enemy line of resistance.

With characteristic attention to detail the manual gives instructions for carrying out this maneuver substantially as follows:

"Area smoke" means the use of smoke to produce conditions resembling a thick fog over an extensive zone. It is important in an attack upon prepared defensive positions, on a static front, or on isolated defended locations behind water obstacles. Area smoke favors close combat, with infantry in a leading role. To prevent the enemy from rearranging his defenses, surprise is a most important factor in attacking under area smoke. Attacking troops must be specially trained and equipped for fighting in smoke.

Thorough reconnaissance and preparations are made before the attack. Suitable points of departure must be selected and occupied, and attacking units must have a thorough knowledge of the terrain and of the defensive capabilities of the enemy. If gaps are left between the attacking elements, it is easier to emplace artillery, and the enemy at the same time may be deceived.

If the main battle zone is of great depth and strength, the Germans may chose intermediate objectives, which are easily recognizable in the smoke and may consist of roads running at right angles to the line of advance, intersecting streams, etc. Such tentative objectives make it possible to correlate the laying of the screen with the progress of the attack.

Prior to laying down the smoke screen, the artillery must soften the area to be attacked. High ground suitable for enemy observation posts in the vicinity of the battle zone is blinded, and enemy artillery is neutralized while the attacking forces are reaching their positions and throughout the course of the battle.

Ground leading up to the battle zone is occupied in advance and cleared of obstacles and mine fields, so that no lengthy delay will occur. Routes of approach to the battle zone are so marked that an unimpeded approach is certain even after the smoke has drifted over them. The attacking unit is brought into position the night before the attack and moves to the line of departure in open order.

Early morning hours are favored by the Germans for the beginning of the attack. The approach of the attacking units is preceded by fairly long area screen fire on the forward approaches of the main battle zone, and a mixture of smoke and HE fire is maintained until the infantry attack approaches this area. The rear observation posts of the enemy are blinded at this same time.

The area screen is laid down in zones 650 to 1,000 feet deep. It may be used as a progressive screen by moving it forward on a time schedule. Then, the rate of advance is governed by the difficulties anticipated in the zones of the fighting and by the nature of the ground, but about 650 feet every 15 minutes is average. Once this screen has been set in motion, it adheres to a time schedule laid down in advance. However, the forward movement of the screen may be delayed until intermediate objectives are attained.

Attack units make effective use of smoke by closely following the progressive screen, in order to carry the attack forward under cover of the smoke. At this stage, visibility is kept at hand-grenade range.

The Germans believe that a head wind gives the attack the best smoke protection, though a flank wind does not prevent the use of area screens, since some of the smoke may be placed in sectors which are not being attacked. However, a wind blowing in the direction of the enemy is considered unsuitable as it precludes use of a screen for close combat. In order to deceive the enemy, the screen must extend over the flanks of the attack area. The screen can be supplemented during the attack by the smoke equipment of attacking units, smoke hand grenades, candles, and smoke shells from infantry guns. These, especially smoke candles, should be supplied in abundance.

The division commander assigns objectives to the infantry commanders, and targets to the artillery. The area screen is laid down by smoke units (*Nebeltruppen*) and artillery, working together under the command of the artillery commander, on the basis of the area to be covered and the time schedule for the screen set by the division commander.

The infantry regimental commander gives the battalion commanders particulars of their assignments in the main zone of battle and objectives to the rear. He attaches to the battalions such special or supporting units as are required, armed with antitank guns, infantry guns, direction indicators, and special weapons. (Figure 17 shows the combat team, consisting of infantry with attached signal and engineer units, for attack in smoke.) After the breakthrough, he quickly reorganizes those elements of the regiment which have become scattered during the attack so that their action may be coordinated in the assault on the final objective. Forces which are assigned to reduce defensive works receive aid from combat engineers with special offensive equipment, such as individual armored vehicles and arms for the engagement of pillboxes. The battalion commanders go forward with the troops and are responsible for their progress through the battle zone.

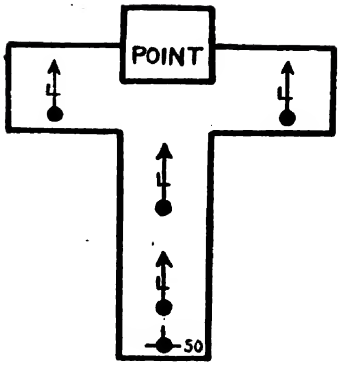
Antitank guns are used by assault groups for the reduction of pillboxes and other centers of resistance in the main battle zone. Radio, even for lateral communications, is employed during the course of the fighting in the smoke-covered area. Additional signal units are attached to provide necessary communication in the difficult circumstances of this type of fighting.

Reconnaissance aircraft are employed to report the effectiveness of the screen and to reconnoiter the terrain beyond. Dive bombing attacks are used against enemy battery positions and against assembly areas or moving columns of enemy reserves. During the assembly of the attacking units, antiaircraft defense is provided.

An attack begins with the entry of the infantry into the main battle zone. It may be necessary, prior to the main attack, to launch attacks by combat teams against individual defensive positions on the near edge of the enemy battle position to facilitate penetration.

Combat teams are thrown in also at points where the defensive position and the terrain offer favorable opportunity for a thrust through the main battle zone. During the battle, combat teams are required to be self-sufficient; their strength must be great enough to insure that they can fight through the main battle zone, over the whole of their allotted sector, and reach the far side in sufficient strength to continue fighting. Combat teams in turn are organized in groups strong enough to advance simultaneously, despite the diversity of opposition which may be met in their particular sectors of the battle zone.

When the German infantry approaches the rear of the main battle zone, the artillery provides necessary fire cover for the spearhead of the attack as it comes out of the smoke into view of the enemy. At this point, enemy forces coming up from their rear to the main battle position are neutralized. Advanced artillery observers with field telephones accompany the attacking echelon and communicate with artillery liaison officers at battalion headquarters. During the advance through the smoke, they



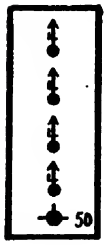
1st Platoon:

Two to three sections in close formation side by side to be able to meet and dispose of any unexpected enemy units in the intermediate sector. Attached troops include guides (to handle directional equipment) and 2 infantry engineer sections for demolition of wire obstacles.

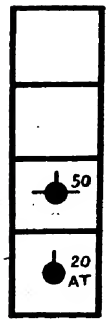
Company headquarters with company commanding officer.

Signal detail with radio apparatus.

Artillery observer



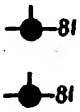
2nd Platoon plus 1 antitank rifle.



3rd Platoon:

Reserve assault troops to seize positions not known in advance, which cannot be bypassed

Attached troops are 2 antitank rifles, 2 heavy machine guns, 2 infantry engineer sections.



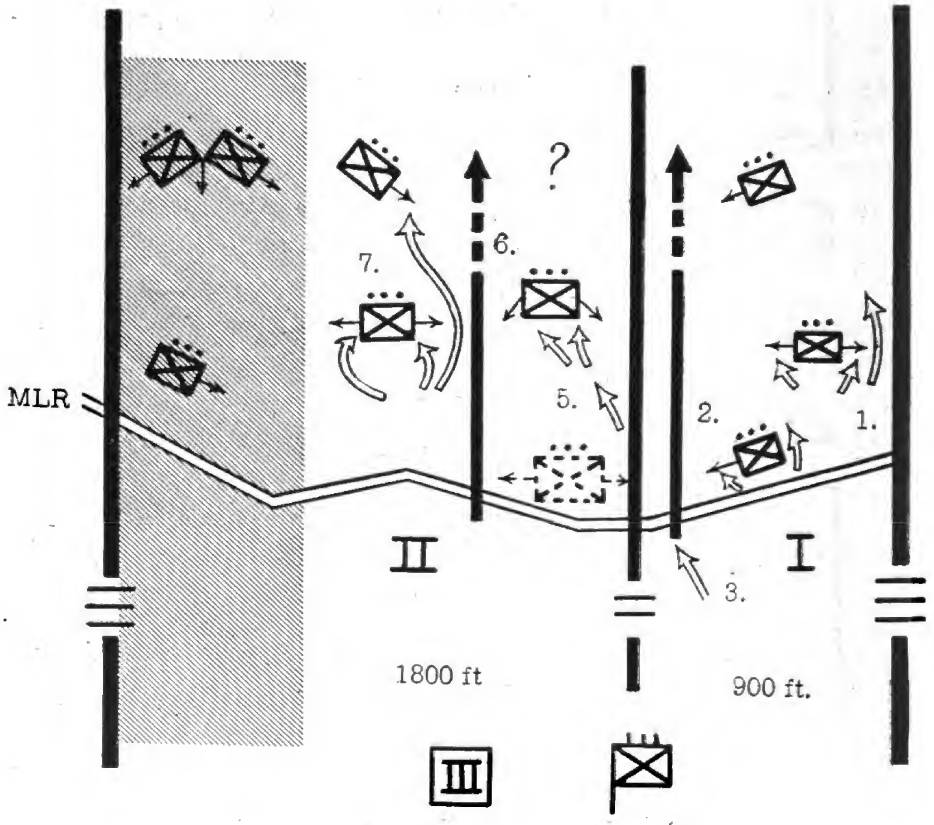
1 section of 2 81-mm mortars.

Ammunition detail from 3rd Platoon.

Figure 17. Composition of a typical German combat team organized for an attack in area smoke.

signal to the observation sections at prearranged times, or when they reach the designated intermediate objectives by means of vertical light signals to reveal their positions to their own observers in the rear.

Figure 18 is a German diagram showing the attack by a regiment under cover of area smoke.



In Battalion II, the 5th and 7th companies are detailed to seal off or capture enemy fixed positions, while 6th company goes straight through the field of battle. That part of sector at left indicated by diagonal shading is by-passed but presumably covered with smoke to prevent effective use of its fire power.

In Battalion I 1st company is detailed to deal with enemy fixed positions, while 2nd company penetrates, followed by 3rd company.

Figure 18. Attack under cover of area smoke.

Since it is necessary but difficult to maintain direction in this operation, the Germans make special arrangements to keep the engaged units properly oriented. In addition to the magnetic compass the following means of maintaining direction are used:

(a) *Radio beam.* The beam is operated by a transmitter and several receivers working in conjunction with it. The transmitter which is set

up at the line of departure, lays a radio beam about 65 feet wide through the smoke in the direction of the objective. The receiver can ascertain at any time whether he is in the radio beam or has deviated to a flank. A special unit of the signal service, attached to the commander of the attacking forces, and moving with their leading units, operates this equipment.

(b) *Direction shells.* These shells which scatter patches of colored powder on the ground (red, yellow, blue) are issued to the infantry gun companies. These rounds are fired before the attack, and make colored patches at intervals of approximately 150 feet along the path of the attack.

(c) *Signal lines.* Lines, about 1,000 feet long, are carried in the direction which it is desired to mark. Their range can be extended by firing another line from the end of the first one, on the same bearing taken from the gyro-compass. These lines thus mark the path of the advance through the zone of attack.

(d) *Direction tapes.* These tapes, in various colors, are laid to mark the paths taken by staffs or units through the smoke. They facilitate report traffic, the maintenance of contact, and the forward movement of succeeding units. Markings on the direction tapes give troops fighting within the screen an indication of how far they have penetrated from their starting points. The employment of these direction indicators, the allocation of the individual colors, and assignments for attacking units are clearly laid down in combat orders.

As soon as the attacking units emerge from the smoke, they re-group immediately to attack objectives, such as enemy artillery positions, which lie beyond the screened area. Antitank guns immediately provide antitank defense. Tank units which have been held in readiness are brought through the newly captured area to attack enemy artillery positions and reserves. Reserves also pour through this break in the enemy lines to exploit the situation and to apply maximum force against the enemy on the far side of the screen.

Generally an area screen is used against an enemy defending himself behind a water obstacle only if there is little current and the stream is narrow. Peculiarities of smoke formation over water are taken into consideration. Ferrying equipment is maneuvered into position under the protection of smoke. The first wave to be ferried over consists of those attacking groups which will deal with forward positions on the opposite bank. The timetable for the smoke barrage takes into account the necessity of organizing on the hostile bank before the thrust into the main battle zone is begun. When the current and the breadth of the stream preclude the employment of smoke for the actual crossing of the barrier, the Germans sometimes deem it practicable to employ area smoke for the subsequent prosecution of the attack through the enemy defenses.

For a front of approximately 1,600 yards in average terrain, the Germans employ one smoke battalion (now called *Werferabteilung*) of three

batteries firing the 105-mm smoke mortar 35 (*Nb. W. 35*). In hilly terrain, batteries are sometimes given smaller fronts.

Ammunition requirements for the smoke battalion may be calculated on the following basis:

For 1 smoke battalion of 3 batteries on a sector approximately 1,600 yards wide, per hour (this includes 1,200 rounds allowance to compensate for unfavorable weather and terrain conditions)_____ 4,200 rounds
One smoke battery for one hour on a sector approximately 550 yards wide_____ 1,000 rounds
Additional allowance for unfavorable conditions_____ 400 rounds
Total _____ 1,400 rounds

Artillery batteries required to lay an area smoke screen are:

For a sector of 165 yards, 1 battery, 105-mm gun-howitzers (*l. F. H. 18*).

For a sector of 200 yards, 1 battery, 150-mm gun-howitzers (*s. F. H. 18*).

For a sector of approximately 1,600 yards, 6 batteries, 105-mm gun-howitzers and 3 batteries, 150-mm gun howitzers.

Ammunition requirements for artillery may be computed from the following table (fig. 19).

Screen	Width of area (yards)	Batteries required	Caliber of howitzer	Time (hr.)	Smoke formation, rounds	Smoke maintenance	
						Rounds in favorable weather	Rounds in unfavorable weather
Blinding or preparatory screen.	165	1	105-mm	1	8 to 16	240	360
	220	1	150-mm	1	4 to 8	120	240
	980	6	105-mm	1	.....	1, 440	2, 160
	650	3	150-mm	1	.....	360	720
Progressive screen	165	1	105-mm	1	20	480	720
	220	1	150-mm	1	20	240	480
	980	6	105-mm	1	.....	2, 880	4, 320
	650	3	150-mm	1	.....	720	1, 440

Figure 19.—Ammunition requirements for area smoke screen laid by artillery.

e. Smoke in Defense. Official German tactical doctrine of the use of smoke in defense is illustrated by the following diagrams, which presumably represent hypothetical situations. In general this doctrine stresses the use of static munitions by small troop units, although in some of the examples artillery, mortars, or rocket projectors would seem to be required.

(1) *To change position under fire.* In figure 20, a heavy machine-gun platoon is under fire of enemy artillery. With wind at 1:30 o'clock, they set down a line of smoke candles that permits them to move to a new position on the hill at the right. Smoke is used to cover only that part of the terrain offering no concealment. Attention is given to wind direction in the placement of candles.

(2) *To permit digging in under fire.* Well-spaced and strong enemy defenses stop an attack at the entrance to a village (fig. 21). In order to allow for further maneuvering later, the attacking force digs in under the cover of smoke, taking advantage of all cover offered by the terrain.

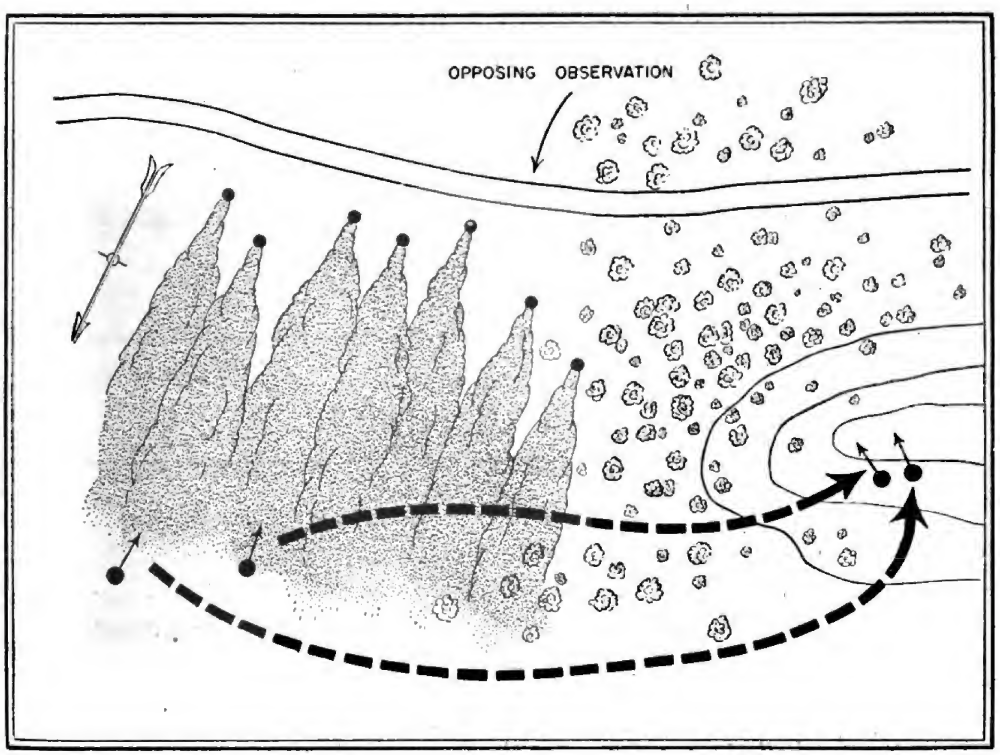


Figure 20. Smoke protects a machine-gun platoon moving to better concealment.

(3) *To facilitate a withdrawal.* A retrograde movement operates under cover of smoke (fig. 22). The withdrawal begins as soon as screen I is set up. Shortly thereafter, screen II is put in operation to give the unit time to reach the cover of the woods at the bottom. Plunging fire from machine guns on the flank also covers the movement.

(4) *To screen tanks from hostile fire.* Tanks withdraw while screened by their own smoke (fig. 23). German tanks are fitted with smoke pots resting in discharger cups, which can be electrically fired.[3] The flank vehicles are screened by smoke from an artillery battery. (It will be

[3] A recent report describes smoke sprayers attached to the front mudguards of armored cars. Presumably they spray a mixture similar to the American FS. Such devices could be used for tanks.

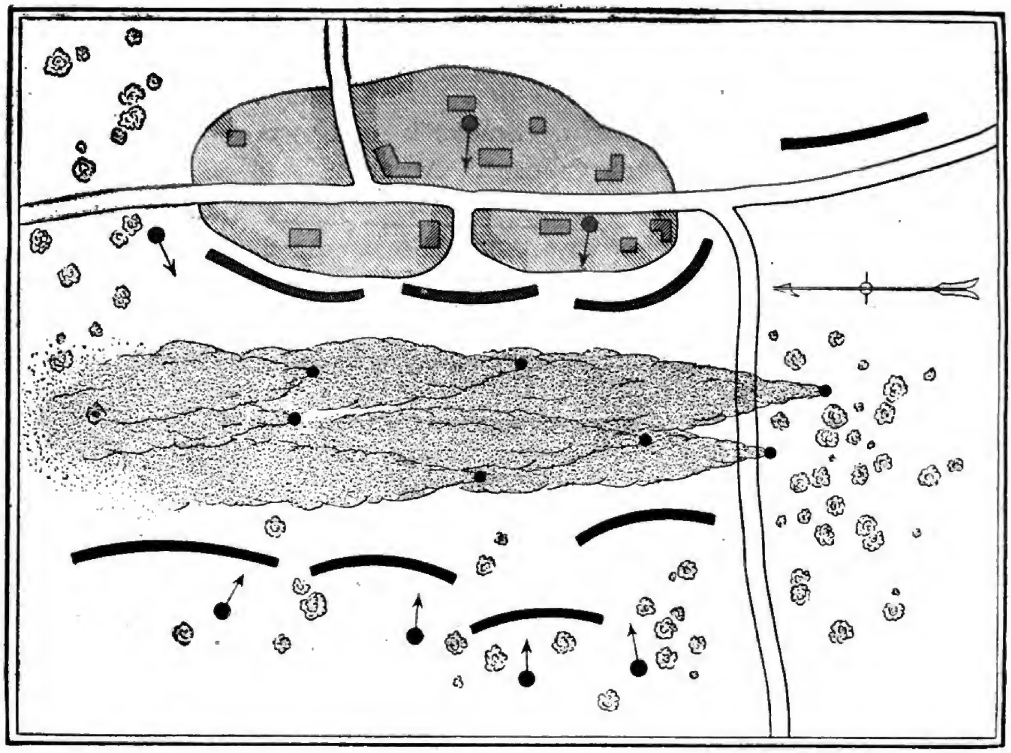


Figure 21. Smoke protects advancing troops digging in under direct enemy fire.

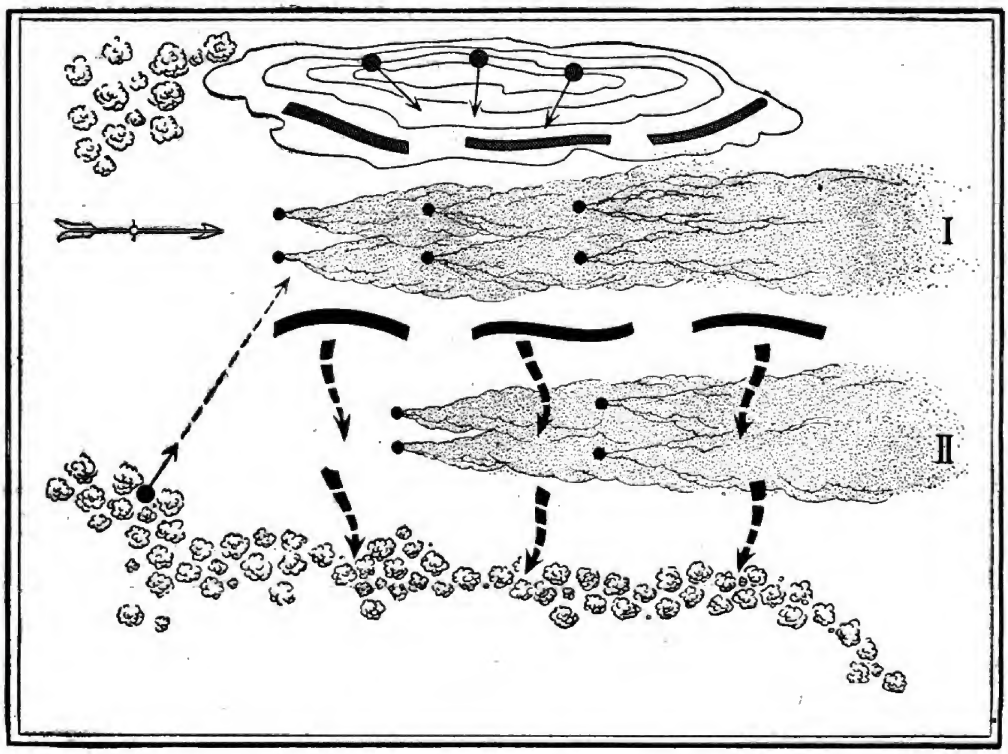


Figure 22. A withdrawal under cover of successive smoke screens.

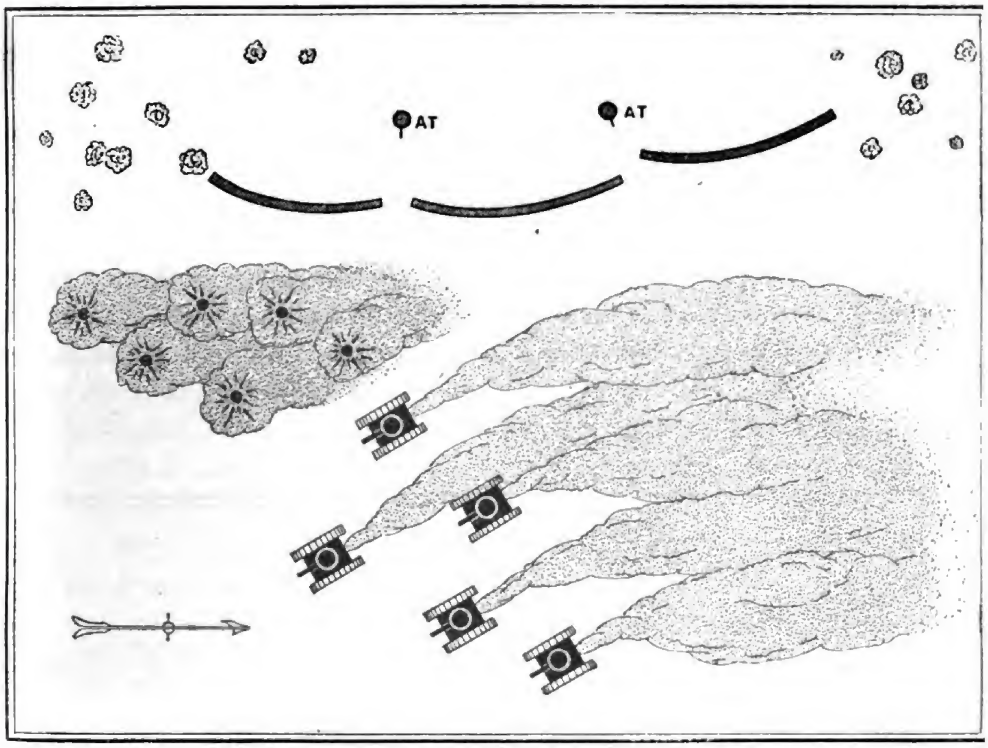


Figure 23. Withdrawal of tanks under cover of smoke from their own pots and from friendly artillery.

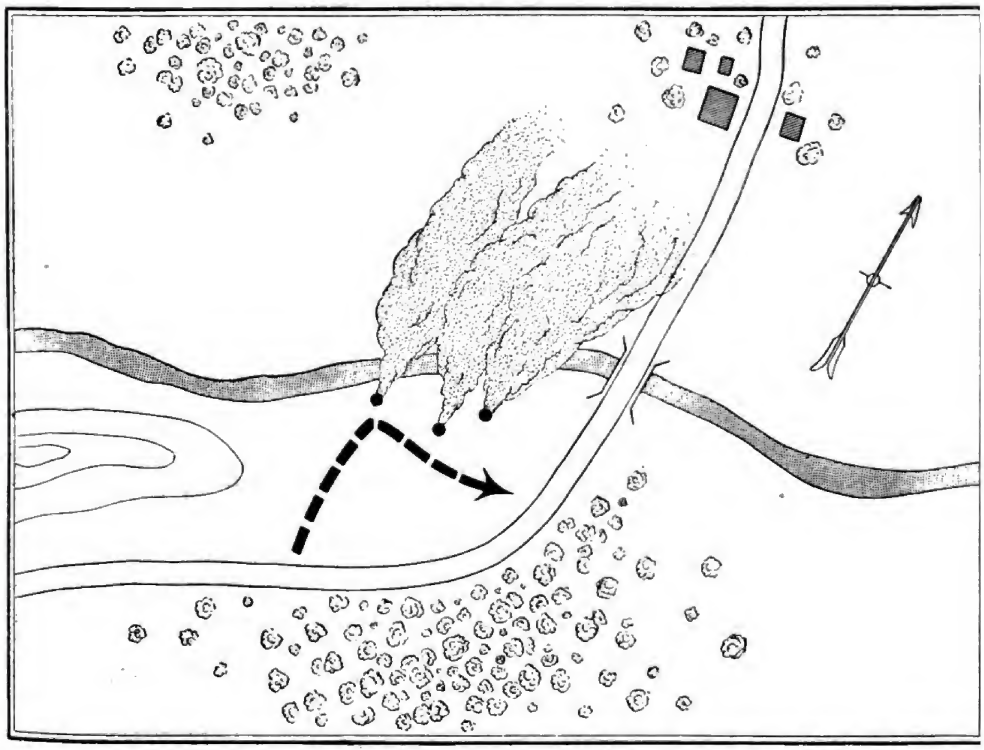


Figure 24. A point of an advancing unit, coming under fire, withdraws under cover of smoke candles.

noted that this calls for quick realization by the artillery observation post of the need of the tanks and a knowledge of how to use wind direction to produce the desired subsidiary screen.)

(5) *To protect small reconnaissance units.* The point of an advancing unit (fig. 24) has to find out if the group of houses in the upper right is occupied by the enemy. If they draw fire from these houses or from the growth of trees at the upper left, smoke candles will be ignited at once and the point will return to the woods under cover of the smoke.

A bicycle reconnaissance squad (fig. 25) suddenly receives flanking fire from the woods at the top. They take cover in the ditch, ignite a few smoke candles, and proceed under cover behind the hill at the left, where they are out of the field of fire of the enemy.

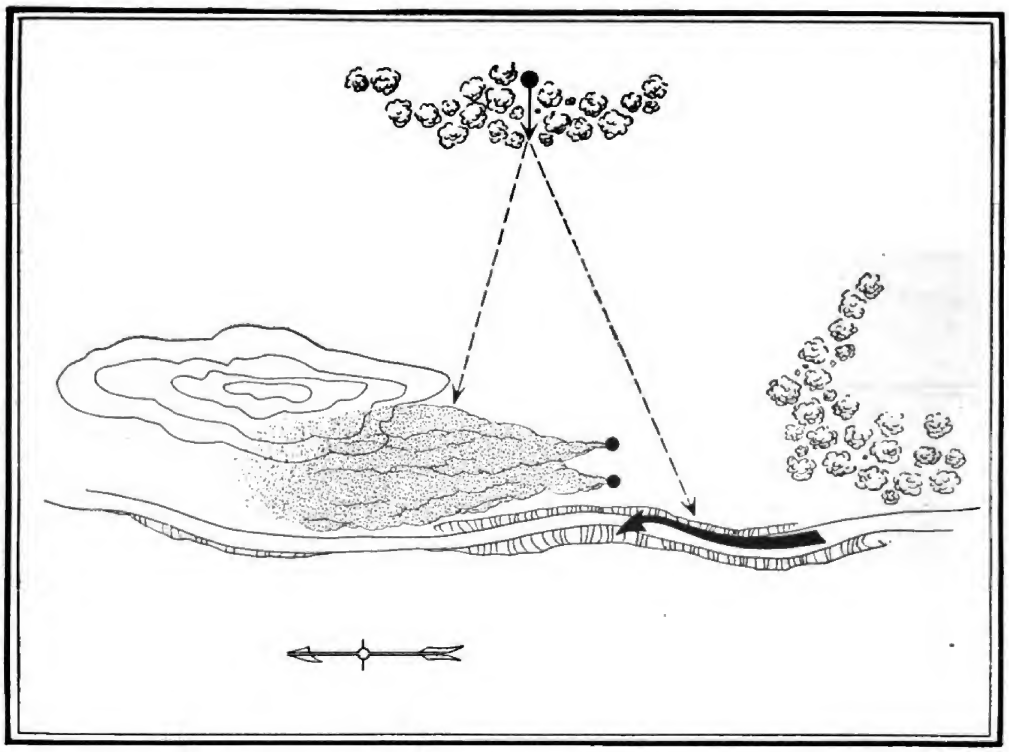


Figure 25. Smoke candles enable a bicycle reconnaissance squad to evade machine-gun fire.

(6) *Use of smoke by tank-destroyer teams.* Information from a number of sources describes the organization of small tank-destroyer teams of 4 to 13 men. These teams are trained to dig individual or 2-man foxholes, 5 to 6 yards apart, at the sides of routes which opposing tanks are expected to use. Advance elements are provided with smoke grenades to blind approaching tanks, and, in some cases frangible smoke grenades which they attempt to break against vision slits. The expectation is that enough smoke will be sucked into the tank to threaten suffocation of the crew and force them to leave the vehicle under the fire of the team. If

the smoke is not sufficient to drive the crew out of the tank, other members of the team attempt to destroy the tank by placing magnetic charges against it, by pulling Tellermines or sliding mines across its path to destroy its tread, or by use of Molotov cocktails broken against its air intakes.

The Germans also have experimented with a technique of tying a smoke grenade to each end of a rope about six feet long. The rope is tossed over the main gun of the tank, and the smoke will be in good position to blind the tank and perhaps to penetrate within.

Two types of tank-destroyer teams, both of which make important use of smoke to accomplish their missions, are described below.

Detachment of 10 men. Tank-hunting detachments consisting of a leader, who is usually a noncommissioned officer, and 9 men, have been organized and equipped as follows: a leader (equipped with a machine pistol, a signal pistol, and 2 hand grenades); a covering detail of 2 men (equipped with a machine gun and a rifle, blue or violet signal ammunition, a blinker signaling apparatus, and 5 hand grenades and 2 smoke grenades each); a smoke detail of 2 men (each equipped with a rifle, 2 smoke candles, 3 smoke grenades, a glass smoke grenade, and 2 hand grenades); and a demolition detail of 5 men (each equipped with a pistol or rifle, a smoke candle, a pole charge, a magnetic hollow charge, and a sliding mine). Figure 26 shows the proposed disposition of the unit.

Detachment of 13 men. Tank-hunting detachments consisting of a leader and 12 men have been organized and equipped in the following manner: a forward obstacle detail of 2 men (equipped with 3 or 4 pressure bars or sliding mines; a rifle, 3 hand grenades, and a pole charger each); a smoke detail of 1 man (equipped with a rifle, 3 smoke candles, 4 smoke grenades, and 2 hand grenades); a covering detail, consisting of the leader and 2 men (the leader equipped with a machine pistol, and each of the 2 men equipped with a rifle and 3 hand grenades); a demolition detail of 2 men (equipped with a pistol, a magnetic hollow charge, 2 pole charges, 2 Molotov cocktails, 2 flares, and 3 or 4 hand grenades each); a rear obstacle detail of 1 man (equipped with a rifle, 2 hand grenades, and a pressure bar); an antitank rifle detail of 2 men (equipped with an antitank rifle, a rifle, and a pole charge); and a machine-gun detail of 2 men (equipped with a machine gun and hand grenades). Figure 27 shows the proposed disposition of the unit along a road.

(7) *Examples of German use of smoke in defense.* An American observer mentions German use of smoke in defense during the early months of 1944 as follows:

> Registration is done in the early morning and late afternoon very frequently with smoke shells, perhaps with two to three rounds only. On the Anzio beachhead following the (German) attack on Tuesday, the 29th (February), it was quite noticeable that the Germans were registering in with about three rounds of smoke on all of

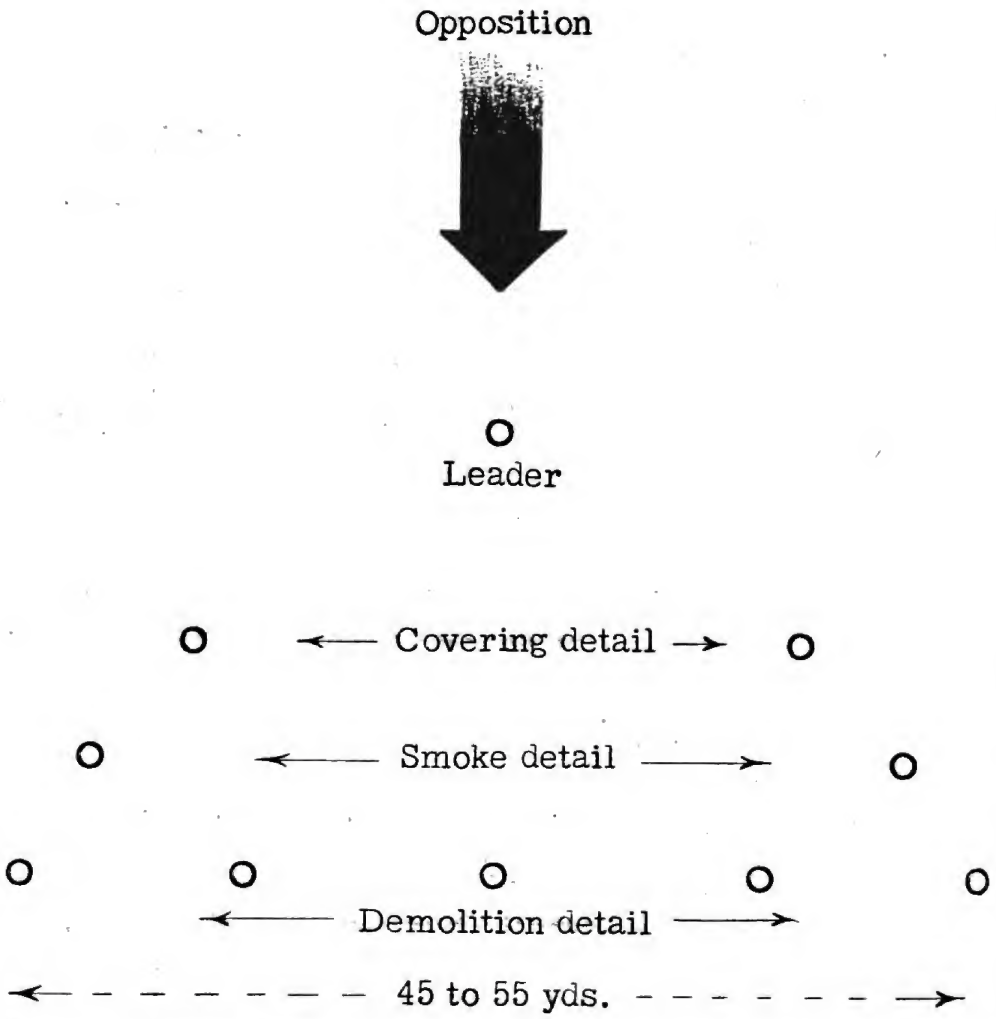


Figure 26. Typical German disposition of a 10-man tank-hunting detachment in fox holes. (The fox holes are likely to be 4 feet long, 1½ feet wide, and chest-deep.)

> the cross roads in the various draws which might be used by our troops in a night movement. (Presumably this was directed against an expected counterattack by our troops which, in fact, did occur.)
>
> German platoons and detachments attempt to infiltrate into our lines and when they are counterattacked usually lay out a smoke screen with hand grenades and small smoke pots and attempt to withdraw under cover of this screen.
>
> Tanks invariably use their smoke screen apparatus, that is, their smoke pot projectors, when they are fired upon and move to safer place under cover of a smoke screen.

From another source comes word of the German use in Italy of smoke pots as a form of booby trap to reveal movement in their minefields during daylight hours. The booby trap consists of a smoke pot (*Nebelkerze 39 B*), an incendiary detonator, the ZZ 35 pull igniter, and trip wire. This type of booby trap has no morale or casualty effect. It is very effective, however, because if tripped during daylight hours it will reveal move-

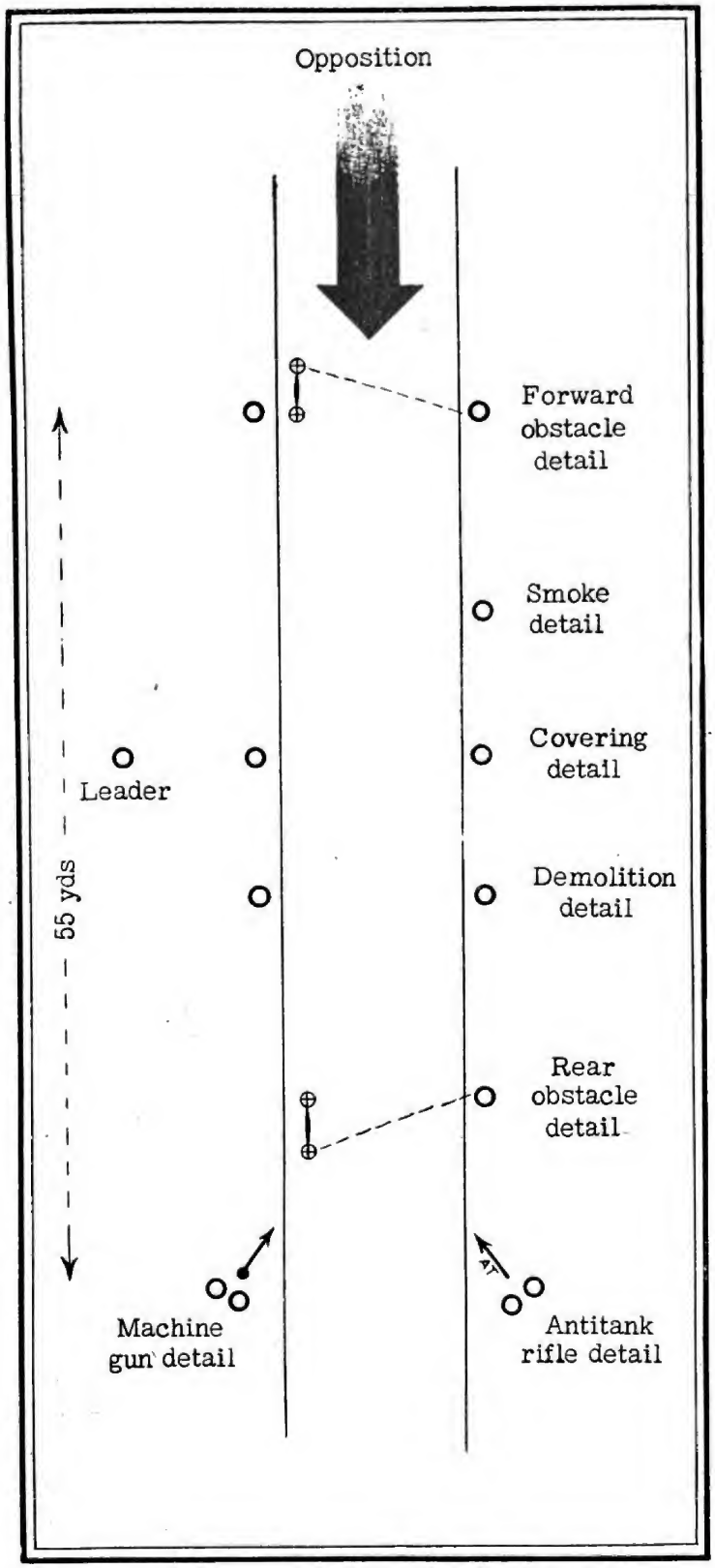


Figure 27. Typical German disposition of a 13-man tank-hunting detachment along a road.

ment, while detonation of an "S" antipersonnel mine or other explosive charge may pass unnoticed by the defenders in the heat of battle.

In at least one instance during the North African campaign, simple but effective use of smoke was made by a German tank unit. Part of an Allied armored division, brought up to help stem a German advance, succeeded in ambushing a column of tanks. Some damage was inflicted, and the Germans withdrew, laying down a smoke screen. The commander of the Allied force waited for the smoke to lift, thinking it could not last long. But it persisted, and, since the terrain did not permit bypassing the screen, he gave orders for his tanks to proceed through. Once the Allied tanks were silhouetted against the screen on the other side, the Germans fired on them with everything they had, and inflicted considerable damage before finally being driven off.

6. SMOKE FROM AIRPLANES. a. General. Although there is no available evidence to prove the Germans have used planes to lay smoke in combat it could be released from planes over ground target areas by means of either spray tanks or smoke bombs. (See figs. 8 and 9.)

As a result of their experiments the Germans believe that smoke is most effective when delivered from altitudes less than 165 feet. One German authority states that the minimum altitude for cloud emission is 100 feet. When bombs are used, the only limitation on the altitude of the plane will be that imposed by the necessity of seeing the target area clearly enough to place the screen where it is desired.

German tactical doctrine on the use of planes to lay smoke screens emphasizes surprise as an important factor. German theory permits the use of smoke by aircraft in the situations described below.

b. In Attack on Ground Targets. In high-explosive bombing or in strafing attacks, German smoke-disseminating planes may be used to blind or neutralize the aimed fire of enemy antiaircraft batteries and thus reduce the danger to the attacking planes. However, premature employment of smoke in such cases may enable enemy planes to intercept and thus jeopardize the effectiveness of the smoke on the antiaircraft positions. The further danger exists that smoke may conceal the actual objective of friendly planes which are attacking. During night bombing, the use of smoke may decrease the effectiveness of enemy searchlights as well as of their antiaircraft fire. Diversion screens may deceive the enemy as to the true objective of an attack.

c. In Antiaircraft Defense. According to a German document, airplanes may lay screens as antiaircraft defense of important installations including airfields, command posts, aircraft factories, arsenals, and economic communication and industrial centers. This use would be expensive and unlikely. In fact, such a method of laying large area smoke screens to cover antiaircraft targets has not been reported, although the

Germans have made plentiful use of large area screens originating from smoke emitters on the ground.

d. In Support of Ground Forces. In the employment of smoke-laying airplanes with ground operations, thorough preparation and perfect co-ordination, including reliable communications, are necessary according to German doctrine. Care must be taken to prevent interference with one's own aerial combat reconnaissance. Tasks that may be undertaken include blinding the observation posts of enemy artillery and machine-gun emplacements by smoke bombs, and neutralizing flanking fire from sectors outside the main line of attack by smoke sprayed from low-flying aircraft. These uses of smoke can facilitate the movement of units under enemy observation in attack or in defense. Similarly, smoke may be placed on the enemy to delay his movements and enable one's own ground troops to withdraw or to break contact with a minimum danger from enemy fire. Consideration must be given to the possibility that smoke may limit or neutralize one's own aerial defenses and may interfere with operations in adjacent sectors as a result of drift.

e. In Support of Naval Forces. Airplanes may be used by the Germans in support of naval operations, to lay smoke to conceal craft and preparations for offensive operation, and to screen landing operations. They also may provide cover for damaged vessels.

7. STRATEGIC SMOKE SCREENS. a. Purpose. The Germans employ strategic area smoke screens for the same purposes and in much the same manner as other warring nations. Screens are used in passive defense against air attack and to obscure such normal bombing targets as harbors and docks; factories; and storage facilities for oil, munitions, or other essential goods. In fact, any installations back of the actual fighting in the combat zone or in the zone of the interior may be protected in this manner. Screens have been reported in operation with varying degrees of success at many places; up to June 1943 they had been observed in 64 places, and photographs of them had been taken at 22 coastal points and 4 inland areas. In the past year numerous other screens have been seen in operation.

Screens are used by the Germans not only to prevent accurate bombing but also to obscure subsequent photographic reconnaissance and conceal the amount of damage done by bombs. Moreover they often are extended beyond the limits of target areas themselves to obscure or obliterate local landmarks and distinctive features of the terrain, such as river mouths and coast lines, which serve to guide bombers to their targets.

Decoy screens, too, may be laid to deceive air crews. Several methods of this sort of deception have been reported. A dummy screen may be laid in open country, short of the target, on the line of approach of hostile aircraft. A second screen may be placed near the screen over a target to serve as a decoy and at the same time cover landmarks. On

nights when visibility is poor a screen may be placed down-wind of the target to tempt bombers to release their loads on the smoke rather than on the target.

Searchlights have been used in conjunction with low-lying smoke screens, not to pick up hostile airplanes but to confuse their crews by the "dazzle" effect of light on clouds of smoke.

b. Methods. The German system of rear-area smoke screening is not unusual. A normal plan consists of an inner ring and an outer ring of smoke generators, reinforced by short lines or arcs at important points within the circles. (See fig. 18.) At ports, which are particularly favored by this type of protection, generators are placed on breakwaters, jetties, and other harbor constructions, as well as on barges or other stationary craft off shore, to complete the ring of smoke and blur the distinct shore line.

Smoke-acid sprayers are generally placed 75 to 100 yards apart, although at some places, notably Berlin, Warnemunde, Gdynia, and Foetten Fjord, they have been placed much closer together. No one plan of disposing generators has been followed everywhere, because the capacities of different types of generators appear to be taken into consideration as well as varying conditions, such as prevailing winds and local terrain.

The time required for the Germans to produce an effective screen seems to be about 15 to 20 minutes, although some have been produced more quickly. The number and capacity of the generators on the windward side of target, and the weather, of course, affect the density of the screen as well as the time required to produce it. It has been found that German screens are maintained in effective density, only with great difficulty, in winds greater than 12 miles an hour.

c. Apparatus. A considerable variety of apparatus to produce smoke is available to the Germans, including some from occupied or satellite countries such as Czechoslovakia or Finland. The most common seems to be a large metal barrel of smoke acid fitted with a simple spray device and connected to a container of compressed air, which forces the smoke acid out through the spray nozzle. The smoke acid is a mixture similar to the American FS smoke mixture. It produces a whitish cloud with effective obscuring power, day or night. Smoke pots of French origin, containing a mixture similar to American HC, were reported to be in readiness for use over Toulon. More recently Toulon is reported to have been equipped with acid smoke sprayers. In harbors, acid smoke floats can be dropped in the water to supplement the effect of other smoke producers. Boats with smoke pots or with smoke acid sprayers are also used in some harbors, and smoke producers mounted on trucks are dispatched as needed to reinforce weaknesses in a screen.

Section III. FLAME-THROWER TACTICS

8. GENERAL. The Germans have shown considerable interest in the use of the flame thrower as a subsidiary weapon, suitable for certain tactical missions. Although primarily an attack weapon, it occasionally has been used in defense. In the latter part of 1943 and early in 1944, the Germans began to use flame-thrower tanks fairly frequently.

9. FLAME-THROWER WEAPONS. Four general types of German flame-thrower weapons are known.

a. Portable Flame Throwers. Four models of portable flame throwers (Models 35, 40, 41, 42) represent a series of improvements. In all models the fuel is forced out of the flame gun by compressed nitrogen; it is ignited in Models 35, 40, and 41 by an hydrogen flame. However, Model 42 has an innovation in that the fuel is ignited by a blank cartridge fired into it. Ten such cartridges can be fired individually so that the operator may expend his fuel in short bursts. The maximum range of this model is 25 yards.

A heavier weapon of somewhat larger capacity is the medium-weight flame thrower. The rear end rests on two small wheels; it is pulled by two men in double harness.

b. Flame-thrower Tanks. Flame throwers are known to have been mounted in place of the main guns in *Pz.Kpfw. II* and *Pz.Kpfw. III* tanks, and possibly also in the *Pz.Kpfw. IV* and in uncovered half-tracks similar to Bren gun carriers.

The *Pz.Kpfw. II* flame-thrower tank mounts 2 flame throwers, operated independently, with nozzles traversing from 9 o'clock to 3 o'clock. Each

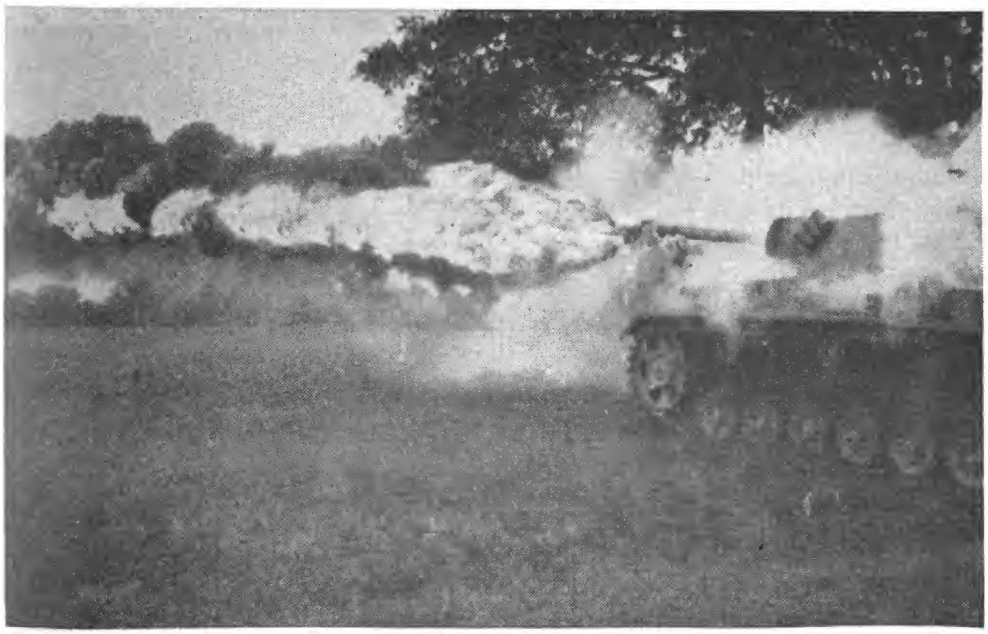


Figure 28.—Flame-throwing tank (Pz.Kpfw. III) in action. (This tank carries the usual smoke pot projectors on the side of its turret.)

flame thrower is capable of about 80 bursts of 2 to 3 seconds each. The working range of this weapon is approximately 33 yards. The *Pz.Kpfw. II* flame-thrower tank is apparently now obsolete, but is reported to have been used in Russia.

Specimens of the *Pz.Kpfw. III* flame-thrower tank (fig. 28) have been captured. In its turret this vehicle mounts a flame gun disguised to resemble the usual 50-mm cannon. This feature permits the flame-thrower tank to be used unnoticed in company with ordinary tanks which provide it protection; it has no defense of its own against antitank weapons. Effective flame range is said to be normally 55 to 66 yards, with a maximum up to 82 yards. In practice, however, the usual flame range seems to be about 30 yards. Two machine guns are carried. Three electrically fired smoke pots, in discharger cups mounted on each side of the turret, can be used to create a local smoke screen for defense.

c. Trailer Flame Thrower. The Germans have a two-wheeled, armored trailer mounting a flame thrower. Maximum range is given as 40 to 50 yards and effective range as 30 to 40 yards, depending on the fuel used. Continuous fire duration is 24 seconds, allowing about 10 bursts of 2 to 3 seconds each. The tactical use of this weapon is obscure.

d. Emplaced Flame-Thrower (Fougasse Flame Thrower). This weapon, copied from a Russian original, is used for defense. The flame thrower is built into a hole or covered with stones so that only a short section of pipe with the nozzle projects and is visible. (See figure 29.) It is a one-shot weapon, fired electrically, with a range of 50 to 65 yards. A number of emplaced flame throwers can be hooked up to the same control panel and fired simultaneously or individually.

10. FLAME-THROWER TROOPS. Flame throwers in the German Army are, in general, operated by the engineers. Flame-thrower tanks, however, are operated by specially-trained tank troops. On one occasion, in April 1944, portable flame throwers were used in Italy by a German paratroop company serving as infantry. They had obtained the flame throwers from an engineer unit and had received about a week's training before actually using them in battle.

11. USE OF PORTABLE FLAME THROWERS. In attacks on pillboxes German tactical doctrine prescribes the use of flame throwers in conjunction with other weapons (see par. 5). Portable flame throwers (Model 41) were used, at the rate of two each, by two platoons of German infantry in an attack on troops in fox holes in Italy, April, 1944. The operators opened fire out of range and continued to fire as they advanced through the black smoke cloud they raised, followed by the remainder of the two platoons. They were stopped before they could reach effective range, and the attack failed. The duration of bursts was approximately 6 seconds, and the range of flame throwers was about 20 yards. In the defense of Ortona,

Figure 29. Emplaced flame thrower (fougasse flame thrower).

Italy, they were used by the Germans, although not extensively, in a role similar to that of supporting machine guns. They were sited behind a rubble pile to cover approaches to street crossings.

12. EMPLOYMENT OF FLAME-THROWER TANKS. a. Doctrine. German tactical doctrine of the employment of flame-thrower tanks, as enunciated in "Instructions Concerning the Organization and Employment of The Flame-thrower Tank Battalion," published by GHQ, Armed Forces (Berlin, 1940), is summarized below.

Flame-thrower tanks are a close-combat weapon of the German tank arm. They are employed where opposing troops cannot be annihilated by small arms, and they have, also, a considerable effect on the morale of the enemy. These tanks require the supporting fire of other tank units or of support weapons to eliminate antitank defense in the area of their operations. They are equipped with two weapons, flame throwers, which are used against live or combustible targets at ranges up to 33 yards, and machine guns, which are used against live targets at ranges up to 436 yards, but most effectively at 218 yards. Flame throwers are used to destroy centers of resistance and are especially effective against field fortifications, static positions, villages, and woods. The flame is expected to destroy troops within its radius or to drive them out into the field of small-arms fire.

b. Organization. German flame-thrower tank battalions are GHQ troops. They are normally placed under the command of panzer divisions, or, in exceptional cases, of infantry divisions (together with other tank units) when used at the focus of major attacks. The flame-thrower tank battalion consists of a headquarters staff, a headquarters company (*without* a light platoon), three flame-thrower companies (for the time being), a repair section, a light transport column, and a tank-workshop platoon.

The flame-thrower tank company consists of: headquarters with two *Pz. Kpfw. II* [1] tanks; three platoons of four *Pz. Kpfw. II* tanks; one first-echelon transport with motorized repair section; one ration echelon; one baggage echelon.

The flame-thrower platoon contains two sections each of two tanks, one of the sections being led by the platoon commander.

c. Employment. German flame-thrower tanks are employed aggressively and are not suitable for protective duties. Both in attack and in pursuit they normally cooperate with other tanks. Employment of the whole battalion is especially effective. For this, the battalion as a rule is subordinated to a tank regiment and attacks with a solid wall of flame. Flame-thrower tanks are employed with the second wave when attacking on the move, if opposing troops have to be rapidly overcome, and

[1] Now probably *Pz. Kpfw. III.* (See par. 9b.)

motorized and ordinary infantry are available for rapid pursuit. The flame-thrower battalion is employed with the third wave against troops in prepared defenses when the flame attack is needed to prepare the way for the motorized and ordinary infantry. When the flame-thrower battalion is employed as an independent wave it must be assigned at least one light-tank company for protection.

Employment by companies is the rule in wooded country, in a sector heavily cut up and containing tank-proof areas, or when attacking single targets or individual sectors of the enemy position. The flame-thrower company is attached to the tank unit in the sector and usually attacks in the second or third wave. A solid wall of flame is the most effective form of attack for the single company.

Employment by platoons occurs when a flame attack is to be carried out at several points simultaneously. For this, flame-thrower platoons are attached to the tank units attacking at these points, in the same way as medium and light tank companies. If the attack turns into pursuit, employment by platoons with the pursuit groups is the rule.

Combat teams of flame-thrower tanks and *Pz. Kpfw. IV* tanks, or flame-thrower tanks and superior support weapons, are formed for tactical missions limited in time and objective: for example, to attack field or permanent fortifications, for village fighting, or against strongpoints which have to be taken by methodical attack.

German doctrine states that the employment of flame-thrower tanks without the support of other tanks requires the previous elimination of enemy antitank defenses in the area. They may be so employed to breach a line of obstacles, to storm field or permanent fortifications, in village or street fighting, quickly to break resistance flaring up after a previous attack by other tank groups, or to clear a way for motorized infantry following in armored vehicles. Whether the whole battalion or only one company is employed for this last purpose, and whether it is put under the command of the motorized or ordinary infantry, depends on the situation and the terrain.

d. Tactics of Flame-thrower Tank Attack. (1) *General.* Preparation for the attack, according to German practice, requires the same ground and tactical reconnaissance, protection, camouflage, and deception as are needed by other tank units. For battle reconnaissance the battalion relies on the results obtained by other tank units, as it has no light reconnaissance platoon of its own. The Germans believe that unprepared employment will make this valuable and not easily replaceable weapon a certain victim of enemy antitank defenses. For this reason, enemy antitank defenses to front and flanks must be silenced before launching an attack with flame throwers. This is the duty of the first wave of a tank attack, of the artillery, and of the support weapons of the motorized or ordinary infantry. When acting as one element in a tank attack, German flame-thrower tank units advance behind the wave detailed to destroy

the enemy's antitank defenses. When employed in direct cooperation with motorized or ordinary infantry units which form the last wave, flame-thrower units may be the last wave of the tanks. To avoid needless exposure to antitank fire, flame-thrower tanks advance to the breakthrough at top speed, after antitank fire has been silenced. Adequate covering fire must be provided to front and flanks by *Pz. Kpfw. IV* tanks of self-propelled antitank guns so that opposing troops may be routed from cover without interference. The attack by other tanks then continues.

When German flame-thrower tanks attack alone, enemy antitank defenses are eliminated by artillery and infantry support units thoroughly acquainted with the local situation. An attack by flame throwers is therefore prepared in great detail and timed to coincide with the covering fire from other arms. This means that the objective is always within the range of the observed fire of the support weapons employed. Therefore, because of the restrictions of locality, the length of time required for its preparation, and the fact that it can only be carried out by bounds, the Germans consider that this type of flame attack is justified only in exceptional circumstances.

If a successful assault turns into pursuit, flame-thrower tank platoons may be put under the command of various pursuit groups, or employed in cooperation with other tanks in combat teams, and thus contribute to the demoralization and annihilation of enemy troops.

(2) *The single tank.* In the employment of a single tank the principles stated below govern German operations.

The jet is discharged in separate bursts from one or both of the spray nozzles.[2] Against troops in fox holes or not dug in, the greatest effect will be obtained by a jet beginning at about 11 yards from the vehicle and burning along the ground for another 22 yards. A sweeping movement of the nozzle while the jet is being discharged will convert the jet into a wall of flame about 55 yards wide. Individual targets that are higher or lower may be hit directly by raising or lowering the nozzle. In other cases the tested normal position of the nozzles should be used. Both nozzles are used together against wide targets that justify the expenditure of large amounts of fuel.

The course of the attack and the nature of the target determine whether the jet is discharged on the move or at a halt. Important single targets are destroyed by halting briefly to engage them. Where a particularly impressive incendiary effect is wanted, the target may first be sprayed with unignited oil and then lighted with a jet-burst. This device is especially effective against trenches, entrances to shafts, and woodwork.

Special caution is necessary, the Germans state, when discharging the jet in the vicinity of cooperating infantry. Where assault detachments of the latter are engaged in attacks on special targets, for example, dugouts,

[2] This applies to the flame-thrower *Pz. Kpfw. II.* (See par. 9b.)

centers of resistance, etc., the spray nozzle is not traversed. No German troops are allowed to move in the direction of the jet. Special attention is paid to the direction of the wind.

The machine-gun fire of flame-thrower tanks is most effective on targets within a range of 218 yards. Bursts are used against isolated targets, against tanks (with armor-piercing, steel-core ammunition) and against deployed enemy troops. Sustained fire is employed against densely massed targets and, provided observation is good, at longer ranges. Whether fire is to be opened on the move or at the halt is governed by the usual principles of tank gunnery.

Battle is joined with machine-gun fire. Protected by the fire of other tanks and other arms, the flame-thrower tank approaches to within jet range at top speed. If the enemy remains under cover, he will be burnt out at close range. Trenches will be crossed and fired from the rear. Entrances to shafts, loopholes, wooden obstacles, and houses are destroyed by the jet. In most cases the Germans find it expedient to spray the target with unignited oil to begin with, and then to light it by a burst from the jet. The tops of trees, roofs, or commanding positions occupied by the enemy are ignited by an upward burst. Bursts are directed only against targets within effective range; haphazard discharge before reaching opposing troops is avoided because it uses up the oil and hinders visibility. In exceptional circumstances the flame-thrower tank may hide temporarily from enemy fire (antitank or artillery) behind the smoke generated by the flames thrown, and, by taking a zig-zag course or getting behind cover, work up to effective flame-throwing range. In thick fog or smoke, flame throwing is prohibited.

(3) *Platoon.* The flame-thrower tank platoon is the tactical unit, and it is not to be split up. If it is detached, it may withdraw its two fuel supply vehicles from the company first-echelon transport and take them with it.[3] The platoon commander directs the platoon by means of radio, telephone, visual signals, firing in certain directions, and by his personal example. He indicates dangerous targets to accompany *Pz.Kpfw. IV* and orders the time of opening fire and the switching off of the nitrogen supply after the engagement. Sections (two tanks) and single tanks may be employed by themselves in flame-throwing attack only in exceptional cases, and even then only within firing range of other tanks which will give protection by observation and fire.

Within the platoon each section forms a combat team. The two flame-thrower tanks fire alternately to provide continuous fire and movement. The platoon flame-throwing attack takes the form of a wall of fire made up of individual bursts from the four flame throwers in the platoon. The platoon attacks in line, so that the entire width of the frontage (approximately 273 to 327 yards) can be attacked by an unbroken wall of flame.

[3] See par. 12e.

At special centers of resistance, for example, antitank shelter trenches, trenches, shaft entrances, and loopholes, the flame throwers will stand by until the enemy is completely destroyed by the flames or surrenders.

(4) *Company.* The flame-thrower tank company is used as a unit for an attack in which it is proposed to burn out one entire sector of an enemy position. The company, in such an attack advances in line abreast. Employment of the entire company as a unit, but specially reinforced by *Pz.-Kpfw. IV* tanks, is also deemed advisable by the Germans for certain special tasks: for example, for breaching lines of obstacles, for gaining important tactical positions, or for street and village fighting. When the flame-thrower attack is made at several points and at different times, the company is employed by platoons in cooperation with tank units operating in the sectors in question. As a rule, the flame-thrower platoons are put under command of these tank units.

When attacking, the company advances in formation as ordered (line abreast or shallow-wedge formation). The machine guns are used only when it is possible to silence worth-while targets without holding up the advance. The important point is to reach the most effective flame-throwing range as fast as possible. To achieve this, the flame throwers halt during the approach and advance at top speed to overtake the first wave as it begins to break through enemy defenses. After this maneuver has been successfully carried out, the other tanks (*Pz.Kpfw. II, III,* and *IV*) cover the thorough burning-out of the enemy in protected positions by concentrating fire upon them. The frontage covered by the company in attack is 872 to 1,090 yards.

Except as indicated, company movement and tactics are similar to those of the light-tank company.

(5) *Battalion.* When the flame-thrower tank battalion is employed for an attack in its entirety as a unit, the companies advance side by side. The plan of attack determines whether one company is held back, after deploying into battalion shallow-wedge formation, for some special duty (flank thrust, reinforcement of the attacking echelon, mopping up). It is usual to employ all companies simultaneously for the first breakthrough in order to terrorize enemy troops and to disintegrate the defense. The frontage covered is 2,180 to 3,270 yards. When the companies are employed separately they normally will be put under the command of tank units during the attack.

Reconnaissance, engineer assistance, and antiaircraft defense on the march and in battle will be carried out by the headquarters company in the same way as in normal tank battalions. In movement and combat, the handling of tanks, channels of command, camouflage measures, organization, speeds, and operational limits of the flame-thrower tanks are otherwise similar to those of other tank battalions.

e. Supply. In the flame-thrower battalion supply is maintained as in normal tank battalions. In addition, refills of fuel oil, nitrogen, and

acetylene are carried. One refill is carried on the tanks, and two refills in standard containers are carried on two fuel oil trucks per platoon, which follow with the company first-echelon transport. A fourth refill is carried in barrels on 10 trucks of the second echelon which, if necessary, may be sent back to the rear, independently of the movement of the column, to get fresh supplies of fuel oil, etc. The company supply of fuel oil is organized by platoons, so that the individual platoons may carry their supply with them when under outside command. In such a case, however, a detached platoon will draw its gasoline, oil and lubricants, ammunition, and rations from the unit to which it has been attached. Refilling with fuel oil and nitrogen takes half an hour, not counting the time taken to reach the tanks. Total time for the company to refill is therefore approximately 1 hour, provided the fuel-oil trucks can be brought up close to the flame-thrower tanks.

f. Operations of German Flame-thrower Tanks. German use of flame-thrower tanks in Italy has been on a smaller scale than that recommended in their training manual, since the terrain has not favored the mass use of tanks. Nevertheless, where only one or two flame-thrower tanks have actually been used, the tactics are similar to those described, and the flame-thrower tanks are escorted by ordinary tanks to provide defense against antitank weapons. In the one reported instance in which this precaution appears to have been neglected, the flame-thrower tank was an easy victim.

The following instances of the actual use of flame-thrower tanks by the Germans in the Italian campaign late in 1943 or in 1944 illustrate the application of the principles of combat stated above.

A unit which has been in action against German flame-thrower tanks in Italy reports that they were employed singly, in two ways: (1) with an assault group of infantry to counterattack a large building in a town, in which case the tank was brought up from reserve, and (2) against advancing infantry, firing on the move from a road on the left flank. Tanks were used also against personnel in houses and trenches, and once against infantry advancing towards a road; they were used in defense of a lateral road, along which the tank moved after each burst of flame. They have been used by night as well as at dusk and in daylight. They were used at maximum flame-throwing range, or even beyond, relying on their morale effect, but were not engaged against opposing tanks.

In one action, two *Pz. Kpfw. IV* tanks and one tank thought to be a *Pz. Kpfw. IV* with flame thrower were used. (The flame-throwing equipment of the *Pz. Kpfw. IV* is probably the same or closely similar to that of the *Pz. Kpfw. III.*) The two *Pz. Kpfw. IVs* opened fire with machine guns at a range of 400 yards from hull-down position. Still firing, they advanced approximately 200 yards to a point where they re-

mained, continuously firing their machine guns. At the same time the flame-thrower tank advanced between the two and attacked. This tank actually reached the edge of the platoon position and sprayed the men at close range. Despite machine-gun and Bren-gun fire, the tanks did not appear to close down. The two *Pz. Kpfw. IVs* remained out of range of the opposing antitank projectors.

It is reported that a German training film shows operations of *Pz. Kpfw. IV* flame-thrower tanks on the Russian front in the ratio of 2 or 3 to 20 or 25 ordinary *Pz. Kpfw. IVs.* The targets were fortified woods, pill-boxes, trenches, and ditches.

A second action took place at about 2200 hours, on a dark night in February 1944, against a platoon of infantry occupying fox holes in a forward position. The attack was made by a German infantry platoon, reinforced by 3 *Pz.Kpfw. IV* tanks and 2 flame-thrower tanks, reported to have been mounted on a *Pz.Kpfw. III* chassis. The attack was preceded by an artillery and mortar barrage that continued for 1 hour. The 3 *Pz.-Kpfw. IV* tanks moved forward and shelled and machine-gunned the position at 50 yards. The German infantry platoon, which was equipped with machine pistols during this action, moved forward with the armored vehicles. When the defending troops attempted to withdraw from the sector the flame-thrower tanks joined the action. They were used intermittently over a 30-minute period, and were said to have a range of approximately 30 yards. Dense black smoke was reported seen after the flashes of the burning fuel, but because of darkness and confusion, no description of flame characteristics could be given. No casualties were suffered, but the flame-thrower tanks had a deleterious effect on the morale of troops.

A third action took place just before dawn, also in February 1944. At that time, buildings at *X* were in the hands of about 20 Germans. Some Allied troops were in position south of the buildings. Two vehicles approached from a northwesterly direction. They were uncovered half-tracks similar to Bren carriers, each mounting a flame thrower. As they approached the Allied position, one of them directed a jet of flame at what appeared to be fox holes approximately 30 to 50 yards away. The flame lasted 1 to 2 seconds. It started in a thin jet approximately 4 feet above the ground, then appeared to shoot along at ground level. The jet fanned out and then died down. The fuel did not appear to continue to burn on the ground, and no smoke was visible. (This report is interesting in that it disagrees with other reports of German flame-thrower tank action in which copious clouds of black smoke were produced by the burning fuel.)

Two *Pz.Kpfw. III* flame-thrower tanks were used in a daylight counter-attack on an Allied position in a village in Italy in November 1943. From the description, it appears that actually only one of these tanks used its

flame thrower. The sketch (fig. 30) and following account are from an eye-witness of the action:

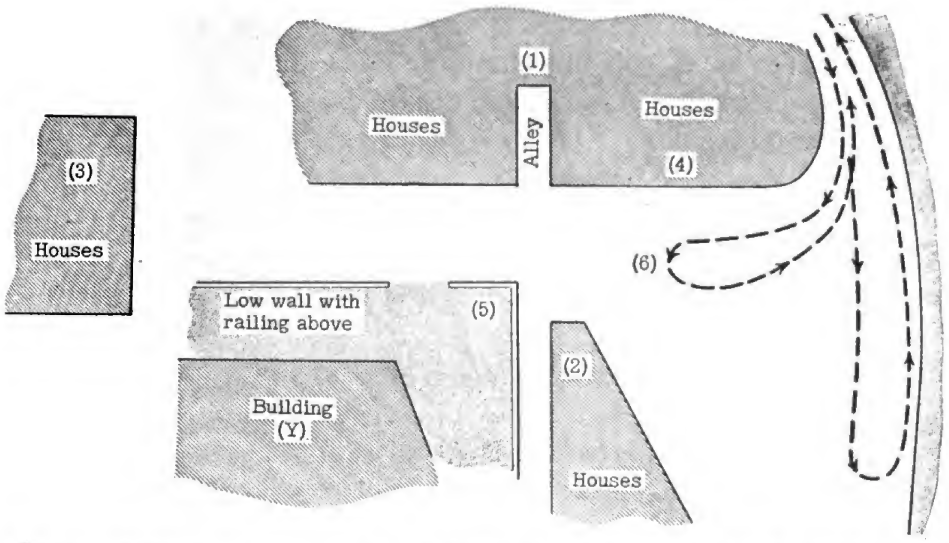


Figure 30. Diagram of actual use of German flame-thrower tank in street fighting in Italy.

KEY

1. Sniper with 9-mm submachine gun.
2. Sniper with light machine gun.
3. Several snipers with automatic weapons.
4. House containing Allied troops.
5. Position of the eye witness.
6. Position of tank when hit by PIAT.

"Owing to the skillful way in which [German] snipers marked (1), (2), and (3) were covering each other, the narrow street in area (6) was untenable by our infantry. C Company was in houses, including houses marked (4) and A Company was in the courtyard around the building marked (Y).

"When the tank followed the route shown, it was already using its flame-thrower. I got the impression of a rolling wall of very red flame, which billowed ahead of the tank, completely filling the width of the street and extending upwards to 10 or 12 feet. It threw off pungent black smoke in large quantities. It behaved very much as the smoke from a smoke shell except that it was a flame and moved along ahead of the tank. I do not think I am justified in saying it extended farther than 20 feet ahead of the tank when I saw it, though others think at times it extended above 20 yards in length.

"I gained the impression that in a narrow street the flame must automatically clear the street ahead of the tank. One either had to get in a house, behind a wall, retire up the street, or be burned. The flame certainly filled the width of the street, and one could not, for instance, wait for the tank to approach and throw a mine under the tracks.

"When it reached (6) the flame stopped much as if it was water from a hose which has just been turned off. There were still clouds of black smoke issuing from it, however. It was here that Major ——

leaned out from a window almost immediately above and fired a PIAT.[4] The tank retired, and I did not see it again until later, when I saw it burned out not far away."

It is reported, but not confirmed, that in this action the German plan was to use seven tanks (all thought to be flame-throwers, but this is not certain). In the approach each tank carried personnel of a panzer reconnaissance unit on the hull. At a given signal, reconnaissance personnel dismounted, and the tank went into action. Reconnaisance-unit personnel were then used to exploit the success achieved by the flame thrower.

This counterattack succeeded because of the effect of the flame-thrower tank on morale, but later the same day Allied units forced the Germans to abandon the position.

13. USE OF EMPLACED FLAME THROWERS. In May 1944 an installation of nine emplaced German flame throwers was captured at a defensive position near a bridge across the River Gari in Italy. The nine flame throwers were at 12-yard intervals and connected electrically in three batteries of three each. They were located to cover an antipersonnel minefield on a likely route of approach to the bridge. When captured, a battery of three flame throwers had been fired. They were buried so that only the nozzle cap was above ground. The lane covered by the flame was rather narrow, but 30 to 40 yards in length. Because of the narrowness of the lanes of fire, the danger to personnel did not appear to be very great except when in the path of the flame. However, the morale effect would appear to be considerable. Fox holes behind the row of flame throwers and in the immediate vicinity were placed so that German soldiers occupying them could cover the field with Spandau automatic rifles.

From the several coastal cities of France, lying along the Mediterranean, and from a northern French port have come reports that emplaced flame throwers have been stalled by the Germans as part of their defense against landing operations. They may be built into shelters, pillboxes, or walls. One report states that they are installed a few yards behind the wire which follows the contour of the high-water mark and are 23 to 28 yards apart, and cited to deliver cross fire. Like the installation mentioned above, the flame-thrower nozzles are said to project only an inch or two above ground, and the ignition of this battery of flame throwers is controlled electrically.

Another report refers to the use of Model 42 portable flame throwers in emplacements electrically hooked up. The range of this model, 25 yards, is considerably less than that of the emplaced type (fougasse type) which is rated good for 50 to 65 yards.

A fourth report refers to emplaced flame throwers used in connection with four or more buried mines at railroad crossings and at crossroads. It is suggested that the electric wires that fire the mines are connected with the flame thrower to subject assaulting troops to a double hazard.

[4] British abbreviation for "Projector, Infantry Antitank."

Section IV. INCENDIARY TACTICS

14. GENERAL. The Germans have made wide use of incendiaries, which represent an impressive proportion of their total munitions during the present war. The tactics involved have been of an obvious order and require no statement in this publication. Therefore, the only incendiary tactics described are those which have some special interest or some degree of elaborateness.

15. INCENDIARY WEAPONS AND MUNITIONS. Incendiary cartridges are available for standard German rifles, machine guns, aircraft machine guns, the larger aircraft cannons, the antiaircraft guns, the 105-mm light field howitzer, and the 320-mm heavy rocket projector, including the trailer and self-propelled versions of that weapon (see figs. 1, 2, and 3). Incendiary aircraft bombs exist in a variety of sizes from as little as 2 pounds to as large as 462 pounds. For close combat, there is a Molotov-cocktail-type of incendiary grenade.

16. TACTICAL USE OF INCENDIARY WEAPONS. a. Against Tanks. Molotov cocktails are used by the special tank-hunting detachments previously described in paragraph 5e (6). Apparently these light, easily handled weapons are considered especially valuable in attack against a fast-moving tank. The intention is to break the incendiary grenade over the air intake and thus force abandonment of the tank.

b. Against Fortifications and in Woods. The 320-mm incendiary projectiles were developed to be fired against fortifications and inflammable buildings, or against an enemy in position in woods which might be set afire to drive them out. These projectiles are not accurate and are fired only on area targets. Specimens have been found, but no report is available to show that they have been used against U. S. or British troops, although there are some indications that they may have been used in the East against Soviet troops. There have been reports of the Germans setting fire to grass on the Russian steppes in combat operations. A single hit of the shell of the 320-mm weapon is said to ignite an area as large as 240 square yards. On explosion, oil is scattered over an area 22 to 27 yards by 11 to 16 yards and to a height of 2 to 3 yards.

c. In Strategic Bombing. Incendiary bombs have, of course, been used extensively in the aerial attacks on Great Britain. A report indicates that German bombers carried a large proportion of incendiary bombs, in some cases perhaps more than 50% of the total bomb load. Explosive incendiaries were also developed with the obvious intention of making it difficult for fire wardens and civilians to put them out.

d. In Air Combat. Besides the obvious use of incendiary bullets in aircraft machine guns and cannon to set fire to fuel tanks of opposing planes, the Germans have employed time-fuzed incendiary bombs in air-

to-air bombing and incendiary disks dropped from planes on formations of American bombers.

(1) *Use of time-fuzed incendiary bombs.* In one engagement reported, a formation of American bombers, flying at slightly over 20,000 feet was attacked for 20 minutes by 50 to 75 German fighter planes, including ME–109's, FW–190's, and MA–200's. The enemy planes dove in single lines from above at about 6 o'clock to a point directly over the formation, using dive bombing tactics, and released strings of what were described as incendiary aerial bombs. The bombs burst "like firecrackers" in clusters around and above the American bombers. The dropping of the bombs occurred in most cases when the German planes were pressing their attacks. One American bomber caught fire as a result of this action.

(2) *Use of incendiary disks.* These are believed to be small, sponge rubber disks, covered or impregnated with phosphorus, and carried in a wet container. As soon as the phosphorus dries, it flames spontaneously and sets the rubber afire. A report states that, during one mission over Germany, clusters of these small disks were dropped from above the paths of American bombers. The clusters descended slowly, keeping a good pattern without dissipating. One crew stated that one of the clusters was 8 feet long by 4 feet wide, while another estimate was 75 feet long by 20 feet wide. These disks may have been dropped by 2 or 4 FW–190's or ME–109's, although this was not directly ascertained. One of these disks set fire to the wing of an American bomber.

PART II. JAPAN

Section I. GAS

17. GENERAL PRINCIPLES. There is evidence that the Japanese are familiar with the basic gas tactics of the German Army and of other armies and that they would base their gas warfare on many of the same principles outlined in Part I of this publication. Those parts of the Japanese Army which are concerned with gas warfare in offense and defense are the special gas troops, the infantry, the artillery, the engineers and the air force. Most important are the gas troops and the infantry. The Japanese may be expected to make the employment of gas dependent on the will of the local commander rather than on directives from the high command, which is German practice. There is also good evidence that they have some independent concepts of their own concerning the employment of gas—ideas arising from the nature of the terrain in their theaters of operation and their limited capabilities, which would have a marked effect on their tactics. Some of the concepts originated by themselves are also based on their fundamental tactics, with their heavy emphasis on infantry fighting and their relegation of artillery, at least until recently, to the role of close support for comparatively small infantry forces.

The Japanese have planes with spray tanks and bombs but in air power, also, they are markedly inferior to the Americans and the British. Their infantry, on the other hand, is well-developed in tactics of quick, concealed movements, infiltration, flank assaults, and envelopments. Although gas warfare has not yet occurred, Japanese front-line troops have for some time been provided with arsenical smoke and tear gas candles and with frangible hydrocyanic acid gas grenades. The evidence seems clear that the Japanese will depend on these and other infantry-operated gas weapons to a very large extent if they decide to engage in gas warfare.

Japanese gas weapons and tactics appear to be well adapted to conditions of jungle warfare. For small-scale encounters—infiltration, attacks on field fortifications, pillboxes, and tanks—smoke grenades and candles, which are easy to employ, could prove troublesome to troops with poor gas discipline. The very nature of these weapons, however, limits their usefulness. They have a very short range and are more dependent on wind

direction and velocity than artillery weapons. That they could be used successfully for a large-scale breakthrough appears doubtful, although Japanese doctrine states that gas may be used for this purpose.

For large-scale gas warfare the Japanese probably would employ to a great extent their Trench Mortar Battalions, which are likely to be armed with 90-mm mortars. For the defensive, the Field Gas Battalions, laying contamination barriers, would play a leading role.

18. GAS TROOPS IN THE FIELD ARMY. On the basis of documentary evidence, the Japanese have a fairly elaborate organization for offensive and defensive use of gas and for protection against use of gas by their enemies. The existence of part of this organization has been confirmed, but the extent of its activation is not known.

On the basis of the best evidence available, gas troops found in the Japanese field army consist of the Field Gas Unit, the Field Chemical Department, and the gas protection personnel of the various arms and services.

19. FIELD GAS UNIT. The Field Gas Unit is the main organization for the use of gas on a large scale in the offense or defense and for large-scale decontamination projects. The Unit is comprised of: Field Gas Unit Headquarters, several Trench Mortar Battalions, several motorized Field Gas Companies (apparently now organized as a battalion) and several pack Field Gas Companies.

a. Field Gas Unit Headquarters. The function of this headquarters is said to be command of lower organizations in the Field Gas Unit, namely the Trench Mortar Battalions and the Field Gas Battalions and Companies. It may be inferred that it would be concerned with larger problems of supply and that it coordinates the activities of the lower units with other arms in the Field Army. In consequence it may be expected to be closely attached to the staff of the Field Army, and its commanding officer would act in an advisory capacity to the staff whenever the use of gas should come into question. The Headquarters, which is motorized, has total personnel of 61, and 10 vehicles at its disposal. It also includes a Meteorological Section, to give up-to-the-minute weather reports which are so important in the conduct of gas warfare.

b. Trench Mortar Battalion (motorized or horse-drawn). At least one, and perhaps several, of these battalions appear to be attached to the Field Army. The mortars used are presumably the 90-mm chemical mortar for which chemical ammunition is known to exist. Some battalions may, however, be equipped with the Japanese 81-mm standard infantry mortar. In case of gas warfare, these mortar battalions would carry a very high proportion of gas shells. See figure 31 for organization of this unit and amount of ammunition carried. In addition the Field

Ammunition Depot (which is not a part of the Field Gas Unit) carries reserves of 480 rounds of all types (gas, smoke, and HE) for each mortar of the Trench Mortar Battalion.

c. Field Gas Battalion (motorized). The number of Field Gas Battalions is not known, but it is believed that there is at least one for each field army. The battalion is used as a whole for major contamination or decontamination missions, or more likely, its companies are separately attached to divisions as required.

A Field Gas Battalion is said to be able to contaminate 405 acres. The gas is sprayed in strips with gaps between; sometimes the strips are broken, giving somewhat of a checkerboard effect. The concentration is approximately 50 grams/m^2 (0.16 ounce per square foot). Either mustard gas or a mixture of mustard and Lewisite would be used, the latter presumably under colder climatic conditions. See figure 33 for organization. The Field Ammunition Depot carries reserve supplies of gas and decontamination materials for the use of the Field Gas Battalion and the Independent Field Gas Company.

d. Independent Field Gas Company (pack transport). It is believed that several pack transport Independent Field Gas Companies are assigned to the field army. While considerably less mobile than their motorized counterpart, they would be able to operate in rough mountainous terrain, where it would be difficult or impossible for the motorized company to proceed. The contamination capacity of the company is a little more than half that of the motorized company. The Independent Field Gas Company can also be used for decontaminating missions. For its organization, see figure 32.

20. FIELD CHEMICAL DEPARTMENT. The Field Chemical Department is attached directly to the Field Army, rather than to the Field Gas Unit. Its functions are "to conduct urgent experiments on enemy chemical weapons at the front, and search for material relating to defense measures in chemical warfare." From the description this appears to be a chemical laboratory company (its personnel total 225) such as is found in other armies. It is conceivable that such an organization may have functions other than strictly chemical warfare, such as the testing of drinking water. This may account for the fact that it is not a part of the Field Gas Unit.

21. GAS PROTECTION PERSONNEL. Throughout all branches of the Army and the Air Force are small units of gas protection personnel. These men probably perform other duties as well as gas protection. They are trained in chemical warfare, especially in defense against chemical attack. It is believed they also are used to train other troops in gas defense. There is evidence that the gas personnel have been trained in the offensive use of toxic smoke (vomiting gas) candles and are employed in such missions on occasion. (See par. 23b: Temporary Smoke Company, below.)

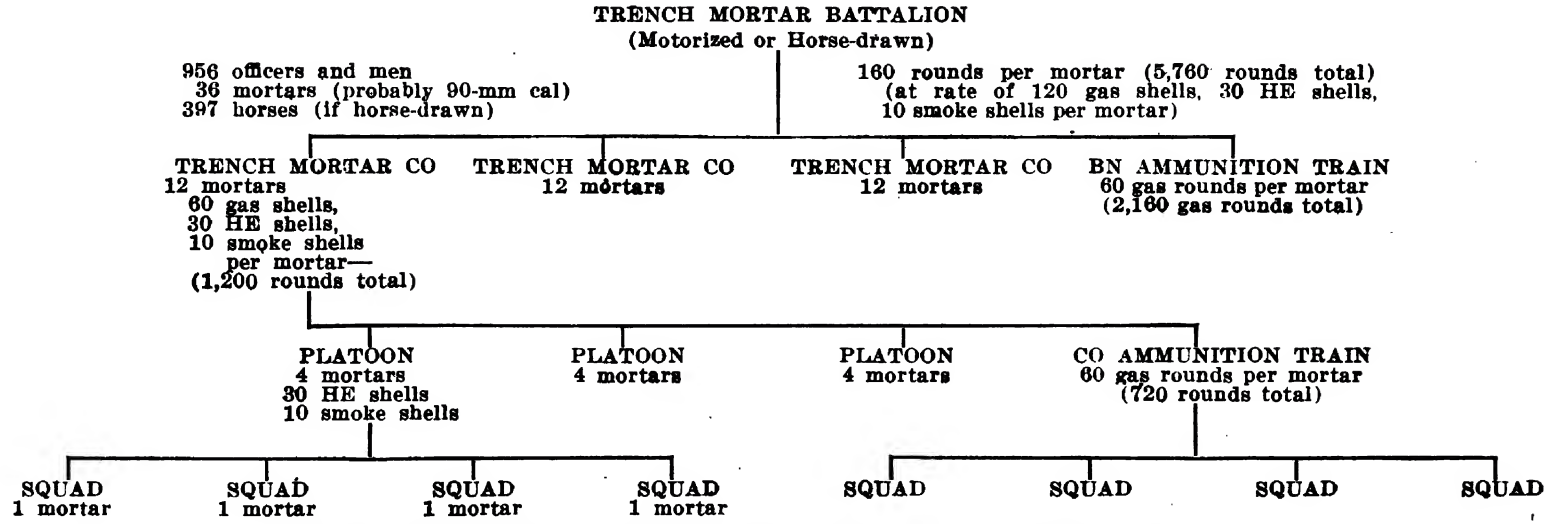
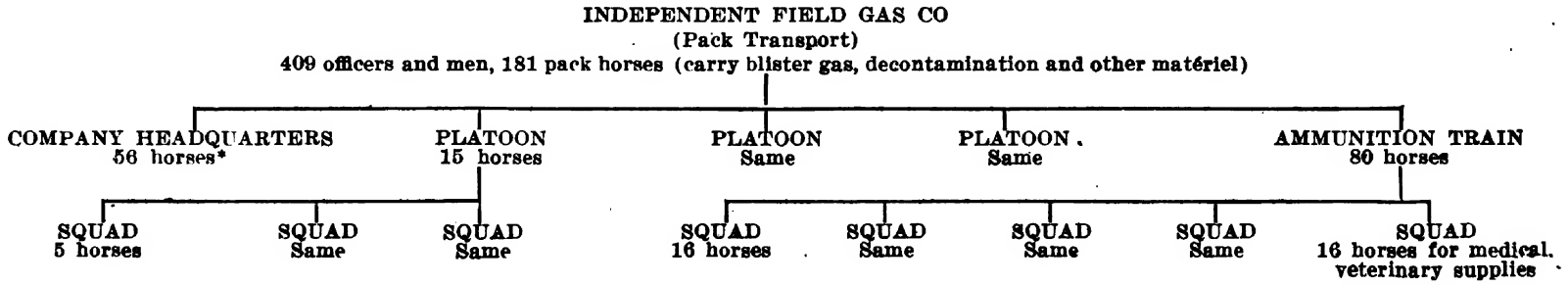
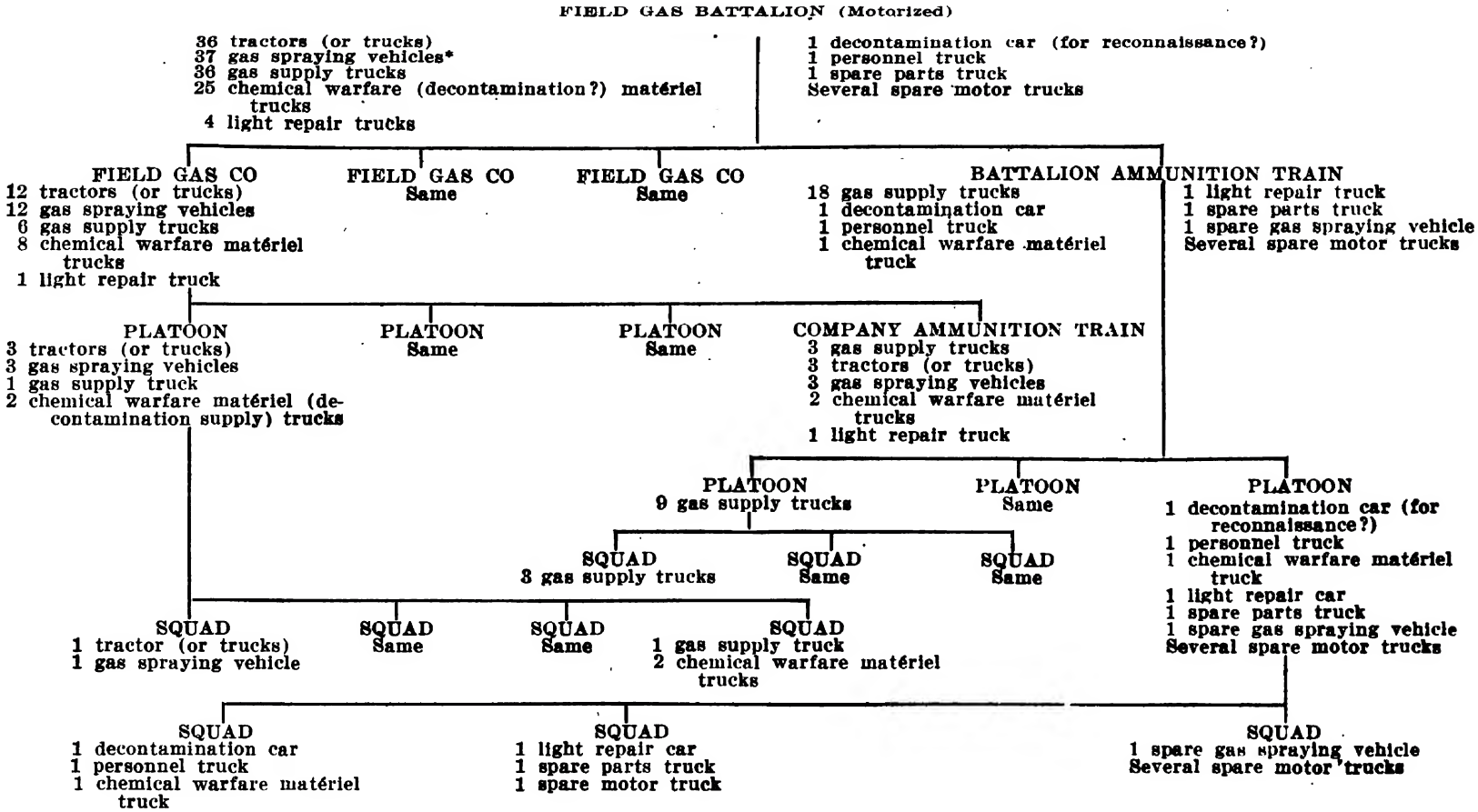


Figure 31. Organization of the French Mortar Battalion (motorized or horse-drawn).



*Number obtained by subtraction on basis of other figures given. It appears to be rather high for a company headquarters.

Figure 32. Organization of the Independent Field Gas Company (pack transport), used for contamination and decontamination (this may be an obsolescent organization).



*Presumably these are trailers with the tractors (or trucks) as prime movers.

Figure 33. Organization of the Field Gas Battalion (motorized).

Gas protection in the Field Army is under the supervision of a captain located at army headquarters. His functions appear to be advisory rather than those of command, unless the gas personnel are assigned to a special toxic smoke mission. In the infantry regiment the gas protection personnel total slightly over 200 and are assigned down to combat and grenade discharger squads, which have two gas men each. There is one gas officer, probably a first or second lieutenant at regimental headquarters and some 25 noncommissioned officers in various parts of the regiment.

22. TEMPORARY ORGANIZATIONS FOR SPECIAL MISSIONS. The Temporary Smoke Battalion and the Temporary Smoke Company are used in toxic smoke missions to supplement the striking power of the mortars and artillery of the Japanese Army.

a. Temporary Smoke Battalion. The Temporary Smoke Battalion is organized when a large-scale toxic smoke attack is to be executed. The personnel of a Field Gas Company forms the nucleus of the temporary battalion. They are presumably supplemented by personnel of an infantry division.

The battalion is composed of a headquarters, with command, observation, communication, and medical sections, as well as an indeterminate number of companies, the number used probably depending on the size of the mission. The number of platoons in a company is also variable. The platoon, however, is constituted of three squads, each of which has a leader, 16 soldiers (of which 4 are used for local defense and liaison), 7 cart drivers, and 6 transport carts with horses. Motor transport is used when available.

The maximum front assigned to a company is as follows:

Unit	Candles	Length of front (yards)
1 soldier	30	.....
1 detail (3 soldiers)	90	55
1 squad (4 details)	360	220
1 platoon (3 squads)	1,080	650
1 company (3 platoons)	3,240	1,960

b. Temporary Smoke Company. The Temporary Smoke Company is made up mostly of the personnel of the infantry regiment who have been trained in chemical warfare. Each company is composed of a company headquarters and three platoons. The platoon is composed of four squads. Three details of three soldiers each make up the squad. The total strength of the company is 165 officers and men.

The purpose of the Temporary Smoke Company is to execute local toxic smoke attacks in support of the regiment. The capabilities of the Tem-

porary Smoke Company and its component parts in frontage of smoke attack are:

Unit	Candles	Front (yards)
1 soldier	15	.....
1 detail (3 soldiers)	45	25
1 squad (3 details)	135	80
1 platoon (4 squads)	540	325
1 company (3 platoons)	1, 620	980

It is to be noted that the capabilities of a Temporary Smoke Company for an infantry regiment is only one-half that of a company of a Temporary Smoke Battalion. The fact that the infantry unit has only half of the transport available to the company of a smoke battalion, 18 as against 36 carts, may account for this.

23. GAS FIRE BY ARTILLERY. The publication "Applied Tactics Japanese Army", for the use of the Japanese Military Academy, revised 1938) has a short section on "Gas Shells Fired by Foreign Armies." Despite the title of this section, which indicates that these are not Japanese tactics, the fact that it is included in a manual specifically designed to instruct Japanese officers in field operations and the fact that it gives ammunition requirements for Japanese artillery weapons, lead to the belief that these have been adopted as Japanese tactics. The Japanese gas shells known to exist are listed in figure 34.

Types of gas fire mentioned are: destruction fire (cf. German surprise gas fire), neutralization fire (partaking of some of the characteristics of both the neutralization and harassing fires of the Germans), and contamination fire. It is interesting to note that the Japanese conception of contamination fire is essentially an offensive one. Following are descriptions from the manual:

a. Destruction Fire. The purpose of destruction fire is to take advantage of a *minor* moving objective, that is, enemy troops, when their defenses are not alert, and to destroy them quickly by a cover of dense gas clouds. Targets are artillery positions, observation posts, machine gun positions, skirmisher trenches, or intersections of communication trenches.

Ammunition requirements: When the wind velocity is below 3 meters per second (6.6 mph), the requirements of quick-acting, non-persistent shells for 1 hectare (approximately 12,000 sq. yds.) are: 100 rounds for the 75-mm field artillery and mountain (infantry regimental gun); 50 for the 105-mm gun, and 25 for the 155-mm howitzer. Thorough preparation is required by employment of all available methods of observation so that

Weapon	Projectile			
	Length (inches)	Weight (pounds)	Chemical filling	Range (yards)
75-mm FA gun...	.....	12½	Crude Lewisite....	6,000 to 7,000.
	11½	12½	50% Lewisite. 50% Mustard.	
	12	11	50% Chlorpicrin. 50% Stannic chloride.	
75-mm Mtn inf gun.	12	13.25	HE/Crude DC....	6,575 to 7,675.
90-mm Cml mort.	17½	12	DA.....	610 to 4,150.
	Burster container or true gas shell: 17½ (?).	11.6	Vomiting gas or choking gas (phosgene (?)).	
	Annular cavity or gas/HE shell: 17½ (?).	12.1	DC.....	
150-mm How....	23	70	HCN.....	

Figure 34. Japanese gas shells known to exist. (Gas shells are known to exist for the 105-mm gun. Other chemical fillings are also believed to exist.)

fire may be highly concentrated and ordinarily completed within one minute.

b. Neutralization Fire. This aims to cover the target area with gas clouds, compelling enemy troops to wear their gas masks for several hours and, in consequence, hindering their maneuverability. Major targets are moderate concentrations of enemy troops and bivouac areas. Minor targets are observation posts, artillery positions, vital points of communication trenches and skirmisher trenches, and passages through deep ravines and forests.

To place neutralization fire on an area of 1 hectare (12,000 sq. yds.) for one hour with nonpersistent agents (tear and vomiting gases) in a wind of less than 6.6 miles per hour, the ammunition requirement is stated to be the same as for destruction fire. Fire begins with a surprise concentration that expends approximately half the number of shells allotted; this is followed by a slower rate of fire with the balance of the shells during the remainder of the time. It is stated that the times of fire and the number of shells fired for the balance of the neutralization fire should be irregular. When a target covers a large area, it is divided up by hectares, and fire is progressive beginning from the upwind side.

c. Contamination Fire. The purposes of contamination fire are to compel opposing troops to retreat from their positions, to make it impossible for them to utilize a key position for any length of time, and to disrupt

communications. Targets are any areas which it is desirable to contaminate, such as forests, bridges, entrances to villages, road intersections, and narrow paths.

For wind velocity up to 11 miles per hour, the same quantity of shells mentioned for destruction fire (par. 23a) is used to cover 12,000 square yards for an hour. A persistent agent, presumably mustard gas or a mixture of mustard and Lewisite, would be used. The Japanese state that the shells must be dropped to cover the area with uniformity, and that fire should be continued to maintain a gas concentration.

According to the manual, attack with gas shells may be employed for annihilation, partial annihilation, or harassment. An attack for annihilation ("complete control of battle") employed in conjunction with a frontal attack by combined forces, has for its objective the complete destruction of the enemy's fighting ability. This aim can only be achieved, however, if the enemy has no gas masks or those used by his forces are of poor quality. For an area of about 3,200 sq. yds. about 400 shells* are required, and one complete mortar company is assigned for the performance of the task.

An attack for partial annihilation ("control of battle") attempts to produce a partial destruction of the fighting forces of the enemy and to give the Japanese forces "extensive control" of the front. A total of 200 shells per 3,200 sq. yds. is needed, and one mortar company is assigned to cover an area not exceeding about 9,700 sq. yds. A harassing attack on the other hand, seeks merely to hinder the enemy's activities, and about 80 shells for every 3,200 sq. yds. are expended to attain the effect.

24. GAS FIRE BY MORTARS. The existence of gas shells for the 90-mm mortar has been ascertained. It is possible that gas shells may be fired from the Japanese 50-mm, 72-mm, and 81-mm mortars, but the evidence is not conclusive. The existence of a gas projector of the Livens type with a caliber of 160 mm also is reported.

It is of tactical interest that there are two types of gas shells for the 90-mm mortar, one with a large chemical filling and a small burster, the other with a large burster or explosive charge and a small chemical filling. These are roughly similar to the German true gas and gas/HE shells. The use of the gas/HE shells presumably would be similar to that of the Germans, that is, mixed with ordinary HE shells or smoke for deceptive purposes.

a. Employment of Trench Mortar Units. A Japanese manual on the use of "special smoke" (gas) describes the employment of a trench mortar company to fire gas shells in support of their own assaulting infantry. The gas fire must be concentrated, it is said, in order to secure surprise, a breakthrough, and a quick overwhelming victory. It also may be used locally to reduce key points of enemy positions.

*It will be noted that the ammunition expenditure for the trench mortar is considerably higher than that for the 75-mm guns in comparable circumstances (see par. 19 Gas Firing by Artillery).

b. Concentration. Effectiveness can be achieved with gas shells only when they are used in profusion. Therefore, it is important that the mortar units be committed as a whole. The mortar company should use all of its 12 mortars, and the battalion should be employed in a unified action. Even two battalions may be utilized for the attainment of a single important objective. Daybreak is the best time to use gas, but twilight is also suitable. The wind should have a velocity under 11 miles per hour and should be blowing in the direction of the opposing forces, but too much stress should not be laid on the latter factor.

In conformity with the Japanese predilection for flanking attacks the manual points out that trench mortar units may be assigned to a detachment on a flanking mission. Such assignments will not be made to an infantry regiment as such unless howitzers are being used in positional fighting. Then, a mortar battalion may be assigned to an infantry regiment to provide supporting fire.

c. Types of Gas. The manual on mortar fire makes no specific reference to a chemical agent beyond speaking of "special smoke". The Japanese 90-mm mortar gas shells, both true gas and gas/HE types, are supplied with vomiting smoke fillings (the latter specifically DC), and a filling of choking gas is also supplied. Directions for use in the manual say nothing about the screening effects of smoke, so that it is possible that the term "special smoke" can be extended to mean any gas cloud.

d. Coordination with Infantry and Artillery. Shells are aimed about 200 meters (218 yards) from the front line, according to the manual. This appears to mean a minimum distance, with a following wind, to prevent casualties to friendly forces from shell fragments, but it may also be designed to allow gas trails to unite by the time they reach enemy positions and thus prevent ungassed gaps in the enemy line. Another document states that "special smoke" (gas) generally is used after HE fire attack has been in full progress. The advantages of this coordination are that HE forces enemy troops to conceal themselves in trenches or foxholes, after which the "special smoke" acts as a screen for Japanese troops who don their masks and advance as soon as the firing is complete.

25. USE OF TOXIC SMOKE CANDLES. A captured Japanese manual on the use of "special smoke" candles gives some interesting information. Captured specimens of these candles have been filled with DC, a vomiting gas. Missions wherein these candles are utilized are undertaken by organizations such as the Temporary Smoke Battalion and the Temporary Smoke Company. For the types of candles used, see figure 35.

a. Suitable Conditions. The same conditions that are suitable for mortar gas fire can be exploited profitably in the use of toxic smoke candles. The manual on smoke candles states, however, that they may be used during the daytime for covering short distances when it is cloudy and the wind is between 6.5 and 11 miles per hour. Weather conditions should be

observed locally, rather than depending entirely on reports of the weather observation corps. The best smoke position is within 218 to 327 yds of opposing troops, but distances up to 545 yds are permissible.

b. Emplacement of Candles. After wind direction has been carefully ascertained, a position is selected where the toxic smoke may be released to best advantage. The candles are placed on the banquette (a projecting shelf in the forward wall) of a trench, or special smoke trenches are built. Each squad is assigned to one or two assembly points, 55 to 109 yards apart. The candles ordinarily are arranged in groups, consisting of double or triple rows with at least 8 inches apart, between candles and between rows. The candles are ignited simultaneously on signal from the commanding officer or at a specified time. Each man ignites from 30 to 60 candles.

c. Number of Candles Used. The number of candles to be used on a given occasion varies with distance from enemy troops, width of cloud desired, effect sought on enemy troops, depth of smoke cloud necessary, and weather conditions. One candle to each 40 inches of a smoke emission line of at least 454 yards produces a cloud 1,635 yards square. A candle every 10 feet produces a cloud 1,090 yards square while one every 33 feet gives a cloud 545 yards square. In general, a localized smoke attack covers an area about 654 yards square. Local attack may be executed by a regiment or by a flank echelon. The effectiveness of toxic smoke cloud concentrations of course depends largely upon the quantity and quality of the enemy's gas-defense equipment.

d. Screening and Toxic Smoke Combined. Screening smoke candles may be used prior to toxic candles to ascertain the effects of air currents and wind. Screening smoke candles also may be used to increase the thickness of the screen when the volume of smoke supplied by the toxic candles diminishes too early. Then too, ordinary smoke can supply the screen when the Japanese soldiers are attacking after the use of toxic smoke.

e. Attack Procedure. Japanese troops advancing after the discharge of a toxic smoke cloud wear their masks. The rate of their advance may be reduced to keep them close behind the smoke cloud, but if necessary they will advance through the smoke cloud before the candles have ceased emitting. When they approach the enemy, the manual directs that they assault vigorously and daringly without regard to hostile flanking fire. They are warned not to waste time, since enemy troops will have recovered from the effects of the toxic smoke within 30 minutes. Clearance of the flanks can be left to the mopping-up units which follow, according to Japanese doctrine.

f. Operations Order for Use of Harassing Gas Candles. A captured Japanese field order describes the intended use of harassing gas smoke candles at Anking. While the smoke was not actually employed, as the opposition encountered was too slight, the order reveals Japanese procedure in the use of harassing gas, including tear gas and toxic smoke (vomiting gas).

Designation	Dimensions		Color	Markings	Total weight (approx)		Smoke mixture	Notes
	Length (in)	Diameter (in)			Gm	Lb		
TEAR GAS								
Tear-gas candle (Type 89).	7. 2	2. 2	Grey.....	Green band.	250	0. 5	CN mixture.....	Main filling nitrocellulose wafers containing CN.
TOXIC SMOKE (VOMITING GAS)								
Small toxic-smoke candle (Type 98).	7. 2	2. 2	Grey.....	Red band..	270	0. 6	DC toxic smoke.	Metal ring handle at bottom.
Medium toxic-smoke candle (Type 97).	9. 8	4. 4	Brown...	Red band..	2, 000	4. 4	DC on pumice..	Metal ring handle at bottom. Under cover 16 taped vent holes. Separate compartment for fuel mixture under smoke charge.
Medium toxic-smoke candle (Type 99).	8. 8	4. 4	Brown...	Red band..	1, 500	3. 3	DC toxic smoke.	Metal ring handle at bottom. Fixed hinged metal prong at side.
Self-projecting toxic-smoke candle (Type 98).	7. 9	2. 0	Brown...	Red band..	690	1. 5	DC toxic smoke.	Projectile has cardboard casing (no longer manufactured).
Self-projecting toxic-smoke candle (Type 99).	8. 2	2. 0	Brown...	Red band..	1, 000	2. 2	DC toxic smoke.	Projectile has sheet metal casing and wooden bottom (old type).
Self-projecting toxic-smoke candle (Type 100).	8. 2	2. 0	Brown...	Red band..	1, 000	2. 2	DC toxic smoke.	Projectile heavy metal container with metal bottom (new type).

Figure 35. Types of Japanese smoke candles.

The order set up within an infantry regiment a temporary gas unit, consisting of eight squads, whose duty was to carry, place, and fire the candles. Each squad was to consist of a warrant officer and five men. Three of the squads were to be formed by each of the two forward battalions, and two by the reserve. The gas squads were to be attached to forward companies or place under their direct command, and the importance of close contact with the assault unit was stressed.

Both tear and asphyxiating gases were to be used, mixed with a large quantity of screening smoke in the attack which was to be delivered at dawn or early evening. The ratio of smoke to gas was to vary from 2½ to 1 to a dilution as great as 5 to 1. Time for use would be evening or dawn. As the candles would only burn for a limited period, the assault troops were ordered to "make use of its instantaneous effect to charge the enemy simultaneously." All units were required to report hourly on the speed and direction of the wind. Tear gas candles not used during the initial stages of the operation were to be employed for later mopping-up within the city.

26. USE OF SELF-PROJECTING TOXIC SMOKE CANDLES. In addition to the ordinary type vomiting gas smoke candles and tear gas candles, designed to be placed on the ground and burned, or on occasion thrown by hand, the Japanese also have toxic smoke (vomiting gas) candles which are self-projecting.

These weapons have a maximum range of about 300 yards. This would be sufficient, when enemy lines are near by, to overcome the limitations imposed on static candles by wind direction. The self-projecting candles easily could be used in a flanking wind, or possibly even in a head wind (from the Japanese standpoint). In effect, these self-projecting candles are small mortars. Since they do not weigh more than 2.2 pounds they have the advantage of being light and easy to transport.

While the effectiveness of these self-projecting, toxic smoke candles in jungle warfare has yet to be demonstrated, they would seem to have some definite advantages, which might make them a potent weapon.

27. CLOSE COMBAT USE OF GAS. Numerous samples of a Japanese glass globe, about 4 inches in diameter and filled with AC (hydrocyanic acid), have been captured in the several theaters. This frangible grenade is designed for use against inclosed spaces such as tanks, pillboxes or houses.

The gas is very volatile, and therefore these grenades would be of little or no use in the open. Hydrocyanic acid is highly toxic and very quick in its action. It would be possible therefore to suck in a lethal concentration through the vents of a tank, for example, and unless the crew masked immediately, they would be casualties.

28. USE OF GAS FROM PLANES. Some use of gas from planes by the Japanese can be expected, although their inferiority in the air will cause

them to put their main reliance for gas dissemination in ground weapons. However, where conditions allow, they would probably supplement their ground gas attacks with gas from planes and use them also as long-range artillery. Little is known of their plans with regard to the use of gas spray tanks, beyond the fact that they have such apparatus. With respect to gas bombs the position is clearer.

They are reported to have made small scale experiments with gas bombs in China. A 110-pound bomb filled with a mixture of mustard gas and Lewisite has been captured. A bomb of the same size, filled with phosgene, and a 33-pound bomb, filled with a combination of HE and toxic smoke also have been reported. An earlier report also mentions gas bombs up to 440 pounds filled with mustard, Lewisite, phosgene, and diphosgene.

29. USE OF GAS IN DEFENSE. a. General. Japanese documents captured so far stress the use of gas in attack. However, they are prepared for defensive use as well.

Their doctrine prescribing the use of gas in attack on concentrations of troops would be applicable in defense when they are expecting a hostile attack. Persistent or nonpersistent gases could be fired under such circumstances.

b. Japanese Gas Tactics in China. Reports have been received at various times of Japanese use of war gas in China. It is said to have been employed in cases in which the Chinese were applying pressure and the Japanese wished to conserve manpower. In general, large amounts were used on small fronts, to support Japanese counter attacks. The chemical operations were never widespread but, rather, concentrated in certain areas and repeatedly used. This may be accounted for by the fact that these were fronts on which the Chinese were exerting pressure.

In all these Chinese operations where gas was employed it was concentrated on the most important section of the objective. Nonpersistent gases were used on the offense, and persistent ones on the defense. Efforts were made to achieve surprise by firing chemical shells immediately after bombardment with HE, as well as by sudden gas attacks. Gas fire was delivered at dawn or evening, with the maximum wind velocity at 11 miles per hour. Smoke was used to hide gas clouds or to precede them.

30. JAPANESE GAS TACTICS AT ICHANG. In the Ichang action of October 1941, a heavy attack was launched by the Chinese to take the city and carry the heights beyond, where a defensive position could be organized. Chinese reinforcements had been moved into the area in late September and early October in preparation for the attack. This movement was observed by Japanese planes, and new defensive dispositions were made, but no sizable Japanese reinforcements were moved up.

Japanese artillery and mortar fire increased in intensity, and considerable amounts of tear and vomiting gas were reported mixed in with the HE

firing, although no gas/HE shells were fired. Between 5 and 8 October some additional mortar companies were reported, and indications are that the bulk of the chemical munitions were fired by them. Harassing gases only were used prior to the Chinese attack, which was launched about 8 October.

The city of Ichang was taken by the Chinese in this attack, and the Japanese retired to the semi-circular ridge beyond the city, fighting a delaying action.

When the Chinese pressed the attack to take this ridge, the Japanese launched counterattacks from both flanks, and great quantities of a persistent war gas were placed on the attackers and the low areas behind them. From 10 to 12 October, planes dropped gas bombs all over the area.

The Chinese troops were either barefoot or wearing straw sandles, without gas masks or protective clothing, and they were severely gassed and burned. Their reserves also were gassed heavily and received many casualties, most of which proved fatal.

Forced to abandon their attack the Chinese had to proceed through low areas to avoid machine gun fire and thus crossed heavily concentrated gas barriers. Laboratory tests of samples of the gas and parts of shells and bombs showed the agent used to be a mixture of mustard and Lewisite.

Use of gas by the Japanese in China in another action to prevent a Chinese crossing of a river is also reported.

31. USE OF GROUND CONTAMINATION. The existence of spray vehicles in the Japanese Army for dissemination of persistent ground contaminants (mustard or Lewisite or a mixture of both) has been ascertained. Gas mines of 11 to 44 pounds, and portable spray apparatus have been reported. Use of such devices in the normal way, to slow up advances of enemy troops, and to facilitate their own withdrawals should be expected, particularly where the terrain is favorable.

A Chinese report states that the Japanese have used mustard gas in defense in front of one of their positions to contaminate an area 2,735 yards by 55 yards. Still another source speaks for use of a defensive belt of contaminated terrain 327 yards deep at the bottom of a ridge position about 1,635 feet high.

One Japanese document in summarizing their tactics in ground contamination, states that it is to be employed at the main points where an enemy attack is expected, with the contamination extending the full width of such points. Where Japanese forces are weak, or it is necessary to economize on their commitment, a large amount of ground contaminant is used as a barrier against the attacking enemy.

The contaminant gas should sometimes be sprayed in areas along the flank of the enemy's position and in areas around which it is desirable to make him detour. Any point tactically important to the enemy should be contaminated.

The width and depth of the barrier of ground contamination is dependent on the tactical sitaution and intention of the Japanese force. The depth of the contaminated zone is determined according to their own strength. Where they have considerable strength, the zone need not be deep, because presumably the heavy fire power at their disposal readily will enable them to turn back the enemy attack.

32. DEFENSE AGAINST LANDING ATTACKS. A Japanese document referring to protection of seacoasts against landings says: "Make the available landing points for the enemy ineffective, or when the wind direction is favorable; utilize poison gas and lay gas clouds over the sea surface where the landing is in course of preparation. Furthermore, as long as there are no hindrances to defensive movements, the use of gas must be vigorously stressed."

33. DEFENSE AGAINST ENEMY GAS ATTACK. A "Gas Defense Handbook" (*Gas Bogo Kyoham*), issued by the Japanese War Ministry and published 13 February 1937, sets forth doctrines of passive protection against gas attack. In familiar terms, and with few deviations from U. S. practice, it discusses the principles of gas warfare, the tactical use of gas, and the duties of officers and men in defense against chemical attack. It lays down procedures for individual and collective protection, first aid for men and animals, and the care and decontamination of equipment. It also provides measures for control and decontamination of gassed areas, as well as for gas reconnaissance, gas security, and meteorological observation.

This handbook and other sources also discuss those measures against gas which are more specifically tactical. As explained by the Japanese, tactical defense against gas centers around quick and accurate estimate of the situation and the unhesitating use of proper expedients to render the attack abortive. Such defense requires constant attention to reconnaissance, familiarity with enemy gas matériel and gas tactics, as well as prepared plans not only for defense against gas encountered but also for counterattack. Accurate estimate of the effectiveness of gas used by the enemy, economical but effective use of antigas equipment, and use of improvised antigas equipment also are requisite.

a. Measures Against Enemy Gas During Assault. When an enemy gas attack occurs, or is expected in the course of an attack by Japanese troops, the area in front of the forward echelon must be reconnoitered, and the effectiveness of gas in the main gassed areas (presumably contamination) determined. Japanese doctrine further holds that contaminated areas in the vicinities of smaller units preparing for the attack must be investigated, and other sources of information, such as aerial reconnaissance, prisoner interrogation, and the reports of gas patrols likewise should be utilized. Reconnaissance of a gas patrol depends upon the mission and the tactical situation. Generally, however, the Japanese attempt to learn the boundaries of the gassed area, whether passages through or detours around the area can be made, and the location of the portion best adapted for

decontamination. They also try to discover the type and freshness of contamination of the gas, and, if possible, the positions and types of enemy weapons that may be brought to bear upon the gassed area.

The tactical situation will determine whether the Japanese attack will start from in front or at the rear of the main contaminated area. Preparations must be made for a forced march to bypass the main contaminated area, in accordance with Japanese doctrine, or decontamination units may be employed to clear paths for passage through it. If the areas is to be crossed, the larger portion of available decontaminating materials will be allocated to the main attack zone, and darkness and smoke screens can be utilized to enable the work of decontamination to proceed without enemy interruption. Enemy firepower allegedly must be neutralized before decontamination is undertaken. If a forced march is to be made around the contaminated area, the Japanese lay emphasis upon the necessity for speed and daring to take the enemy by surprise; and the constant maintenance of proper gas discipline by Japanese troops is stressed.

b. Crossing of Contaminated Areas. An unusual method of assault through contaminated areas is described in Japanese manuals. Instead of decontaminating paths through the barrier, a series of strips at right angles to the direction of the attack are decontaminated from one edge to the other. (See fig. 36.)

The area then is crossed in a series of rushes from one decontaminated strip to another. The distance between the decontaminated strips is the space of contaminated ground that can be crossed in one rush, and it is made progressively smaller as it approaches enemy positions on the far side of the contaminated area. Decontamination is accomplished by a decontamination squad equipped with hand sprinklers, presumably at night or

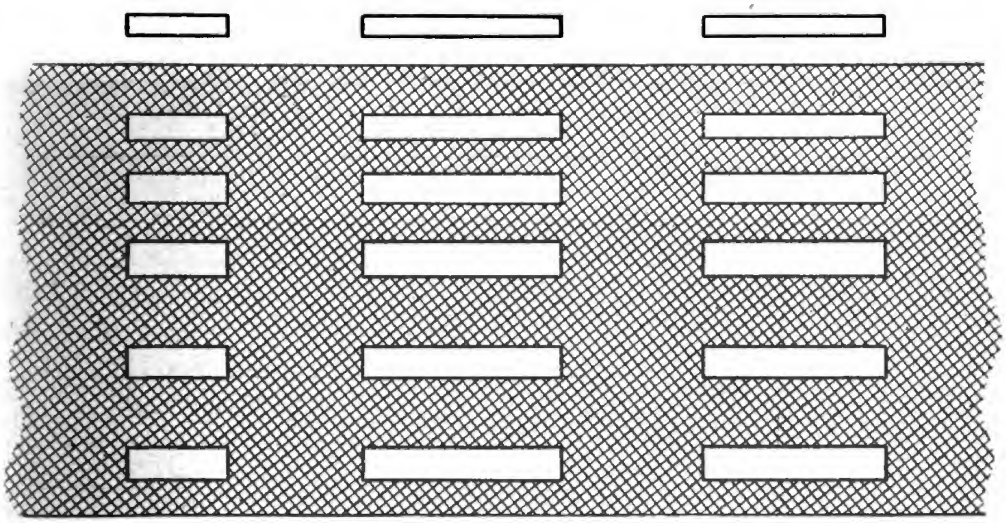


Figure 36. Japanese method of crossing contaminated terrain by decontaminating a series of strips. Men advance to a skirmish line by a series of rushes from strip to strip.

under cover of smoke. The width of a decontaminated strip is about seven feet, and the length is that which can be covered by one sprinkler. As far as the situation permits, decontaminated strips are made near the far edge of the contaminated area to permit troops who have passed through to decontaminate affected parts of their bodies and their clothing before proceeding to the assault. This maneuver, however, would appear to be feasible only in relatively clear terrain, without heavy brush.

Tanks pass through a contaminated area by closing down all apertures. The crew put on their gas masks. The same defense is used against cloud gas attack or spray from planes.

Section II. SMOKE TACTICS

34. JAPANESE DOCTRINE OF THE EMPLOYMENT OF SMOKE. In Japanese tactics there is a close relationship between gas and smoke, since a high degree of reliance upon candles to produce both screening smoke and toxic (or "special") smoke is a feature of their system. Therefore, some of the principles governing one are applicable to the other.

A Japanese manual on the tactical use of screening smoke states: "Smoke is effective in obstructing the vision and in minimizing the fire power of the enemy while at the same time giving him a feeling of uncertainty, but it is lacking in destructive power. It is important to increase its effectiveness by properly using fire power with smoke. For this, use fire power adequately after or during the release of smoke. Divert the enemy in a gap, or outside of or in the rear of the smoke screen by fire power."

Elsewhere in the same publication reference is made to objectives "such as the concealing of our movements, the lessening of damage which might be caused by the enemy, the deceiving of the enemy, or interference with his movement. Smoke is used to cover the enemy directly or to establish a smoke screen between the enemy and ourselves for the purpose of concealing us from the enemy's sight and from enemy fire. But at times the use of smoke screens to cover ourselves is unavoidable."

35. SMOKE WEAPONS AND AMMUNITION. Smoke shells are known to exist for the 50-mm grenade discharger ("knee mortar"), the 81-mm mortar, the 70-mm infantry battalion howitzer, the 75-mm and 105-mm guns, and the 150-mm howitzer. It is believed that smoke shells for the 70-mm infantry mortar, the 90-mm light trench mortar, and the 75-mm field and mountain gun are available. There is also a spigot rifle smoke grenade. (See fig. 37.)

Probably of greater importance than any of these, however, are the screening smoke candles. The Japanese lay great stress on the use of these simple weapons which are easy to carry and apparently effective. There are two important types: the stationary candle which can also be used as a smoke hand grenade, and the self-projecting candle which acts in principle as a miniature mortar. Floating smoke candles also exist, designed to be

Type of munition and weapon used	Weight munition (lb)	Smoke emission period (min)	Length of effective screen (ft)	Width of effective screen (ft)	Number of shells required for mission (assuming flank wind of 7 mph)			
					Number of guns per battery	Width of front screened (ft)	Rounds per gun to estab.	Rounds per gun to maintain
50-mm shell (Model 11)—grenade discharger (Model 10).	1.2	A very short period	39	7	.....	.....	.....	
70-mm shell (Model 11)—Inf Mort (Model 11).	6		49	10	.....	.....	.....	
75-mm shell (Model 11)—FA gun (Model 38) Mtn (Inf) gun (Model 41).	12		98	16	4	328	6	2 rds per min.
105-mm shell (Model 14)—FA gun (Model 14).	58		98	16	4	492	4	3 rds per 2 min.
150-mm shell (Model 13)—FA How (Model 15).	73		328	33	.....	.....	.....	
90-mm "continuous smoke" shell (experimental)—lt trench mort (Model 94).	19	1-5	328 to 492	164–?	12	3,280	2 (with following wind, 3 rounds).	1 rd per min.

Figure 37. Capabilities of Japanese smoke weapons (based on official Japanese figures)

Type of munition	Weight (lb)	Smoke emission period (min)	Length of effective screen (ft)	Width of effective screen (ft)	Fuse delay to detonation (secs)	Time of flight (secs)	Maximum range (ft)
Type 94 smoke candle A (small)	2.2	2	230 to 328	164 ft from the candle the width of the screen is about 66 ft			
Type 94 smoke candle B (small)	1.7	4	164 to 262				
Type 94 smoke candle A (large)	44	4.5	2,296 to 3,280				
Type 94 smoke candle B (large)	35	8	1,148 to 1,640				
Type 94 floating smoke candle A	20	6	984 to 1,640				
Type 94 floating smoke candle B	15	11	656 to 1,312				
Experimental self-projecting smoke candle	1.5	2	164 to 328		3	6	492
Type 99 self-projecting smoke candle	2.8	1.5	164 to 328		7	8	200 to 300

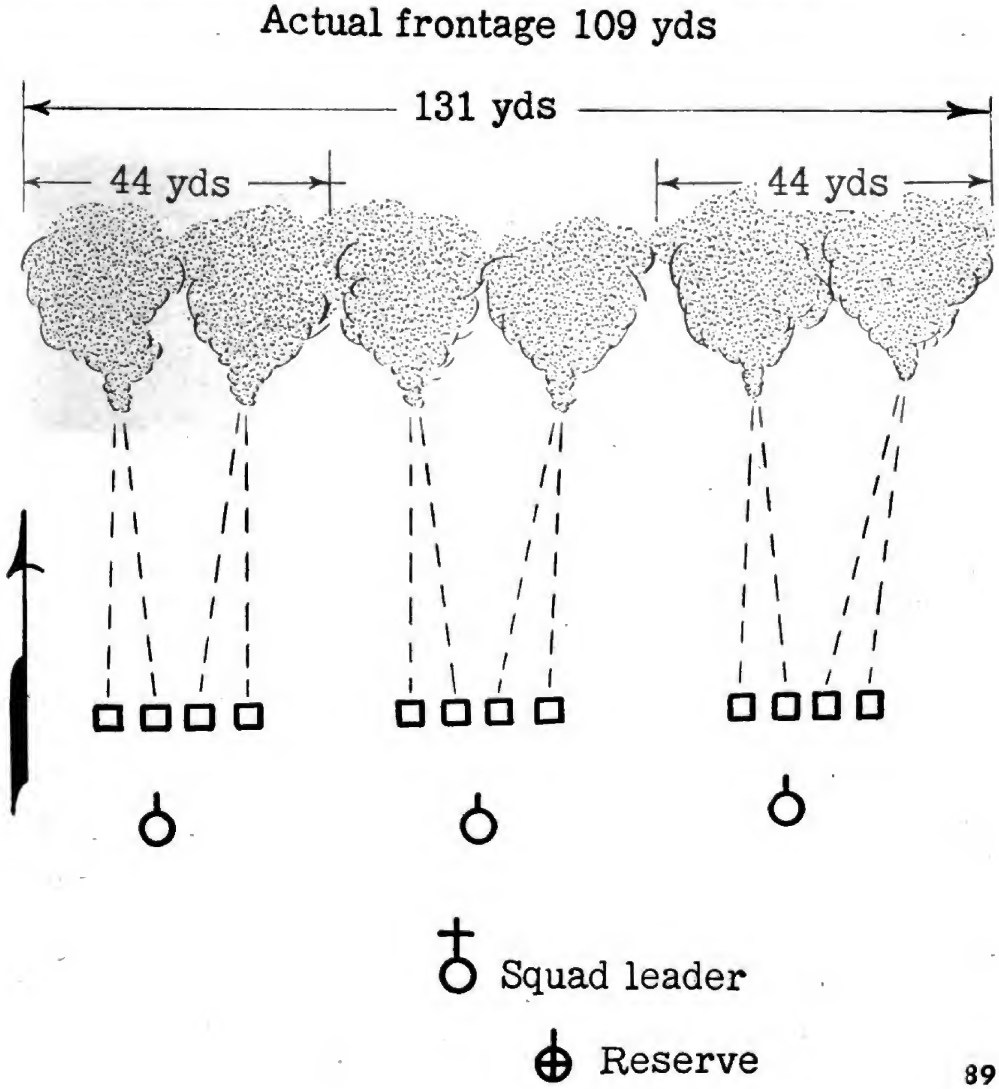
Figure 37. Capabilities of Japanese smoke weapons (based on official Japanese figures)—Continued.

used at sea or in rivers and harbors, and, on occasion, on land.

A frangible smoke hand grenade, similar to that of the Germans and probably intended for use against tanks and pillboxes, is also provided.

36. **SMOKE TROOPS.** Most troop units are prepared to fire smoke munitions, but in smoke operations of any magnitude the organizations described in paragraph 19, are employed. It is believed that the 90-mm light trench mortar (Model 94) is the weapon of the Trench Mortar Battalions (see fig. 31). It presumably is used in support of assault troops, firing gas, smoke, or high-explosive shell. The 90-mm mortar is designed for putting up a smoke screen on an extended front; other smoke weapons provide local or temporary screens.

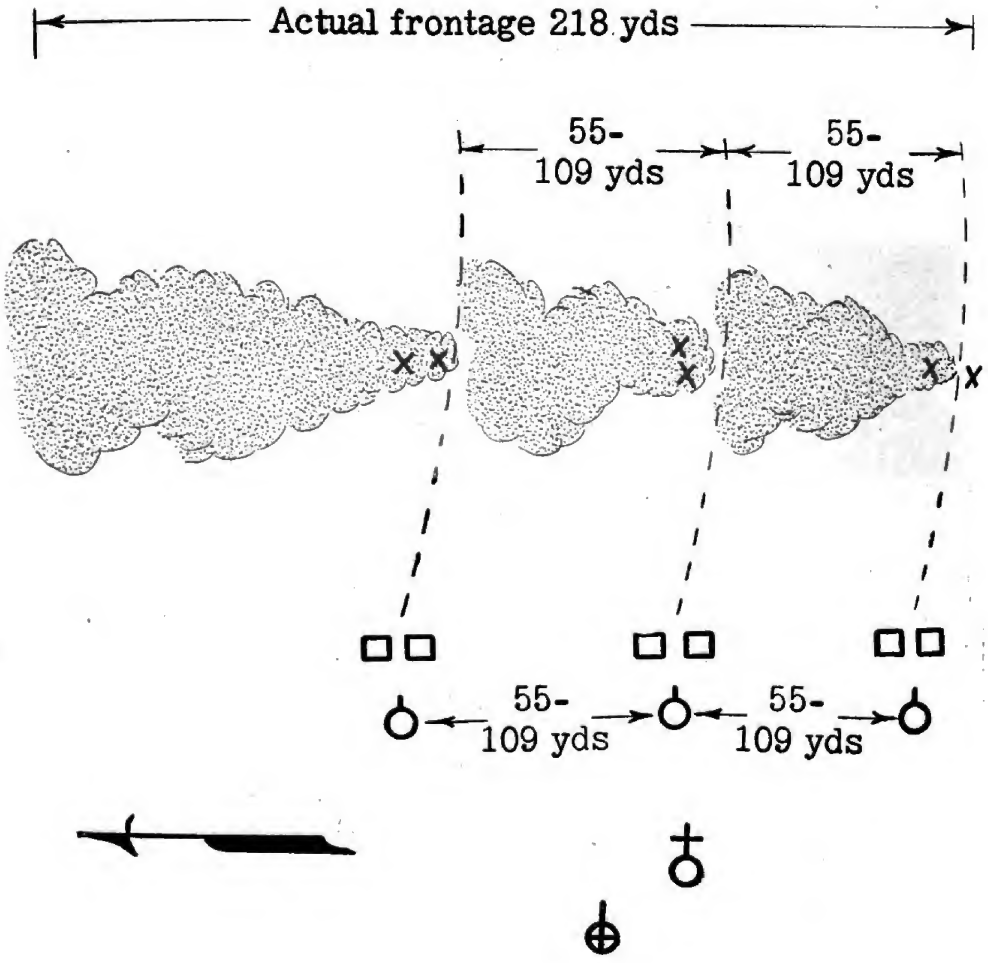
For smaller operations, the candle is the most prominent smoke weapon. The squad is the basic unit, and usually consists of a leader and four men, one of whom is a relief. The frontage to be covered varies from 109 to 327 yards. Each man, except the relief, is usually in charge of three release points for stationary candles, of two for self-projecting candles.



37. TECHNIQUE. a. Self-Projecting Smoke Candles. The range of these candles depends on the condition of the soil at the firing point. On ordinary ground, the range will be about 218 yards if the firing angle is 45 degrees. Hard ground, or a suitable hard base such as heavy timber, must be provided if the maximum range of 327 yards is to be attained. To shorten the range the Japanese officially recommend moving the firing point farther to the rear rather than altering the angle of discharge, which cannot be done accurately. However, with a firing angle of 80 degrees, the range will be about 109 yards. Aiming is done by sighting along a white line which runs the length of the candle; allowances naturally must be made for lateral winds.

Dispersion of the self-projecting candles is considerable. Four candles fired on one point will give a dispersion zone 22 to 55 yards long by 11 to 22 yards wide. It is therefore recommended that at least two candles be used to cover a point. Specific duties are allocated to personnel as follows:

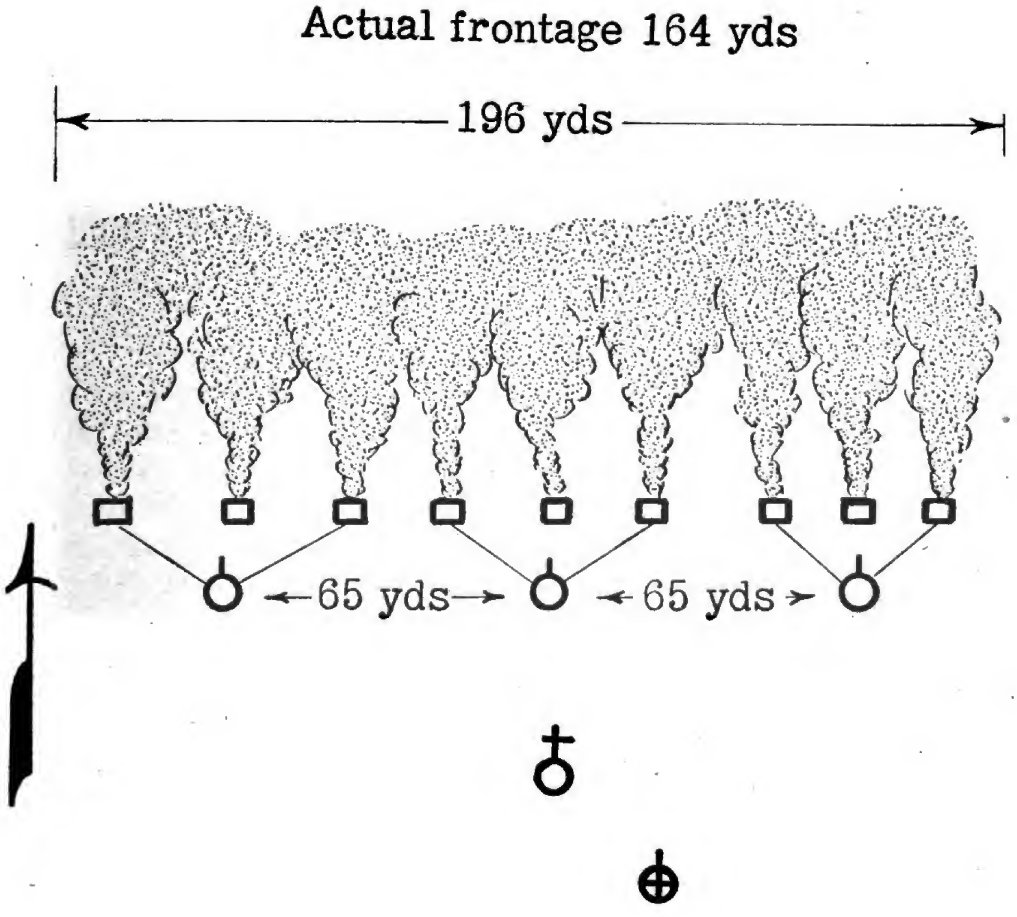
(1) *In following winds.* Each man fires two self-projecting candles at a time in the two directions assigned to him. The intention is to have each pair of these candles fall approximately 22 yards apart on a line approxi-

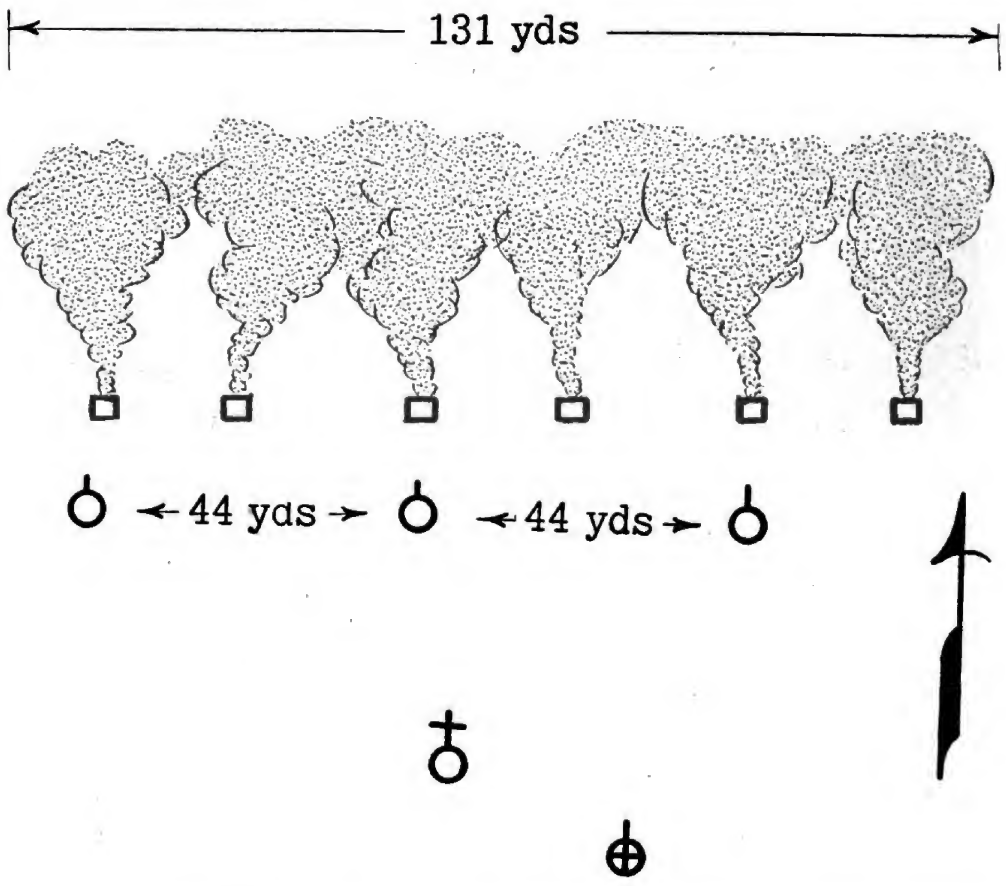


mately 218 yards from the firing point. The smoke screen under these conditions will be approximately 131 yards in width. See page 89.

(2) *In flank winds.* The same technique governs the firing of self-projecting candles in flank winds except that the candles are fired to windward of the objective. In making progressive screens to approach convenient assault distance, the space between screens varies with the tactical situation, but about 109 yards is the average. See page 90.

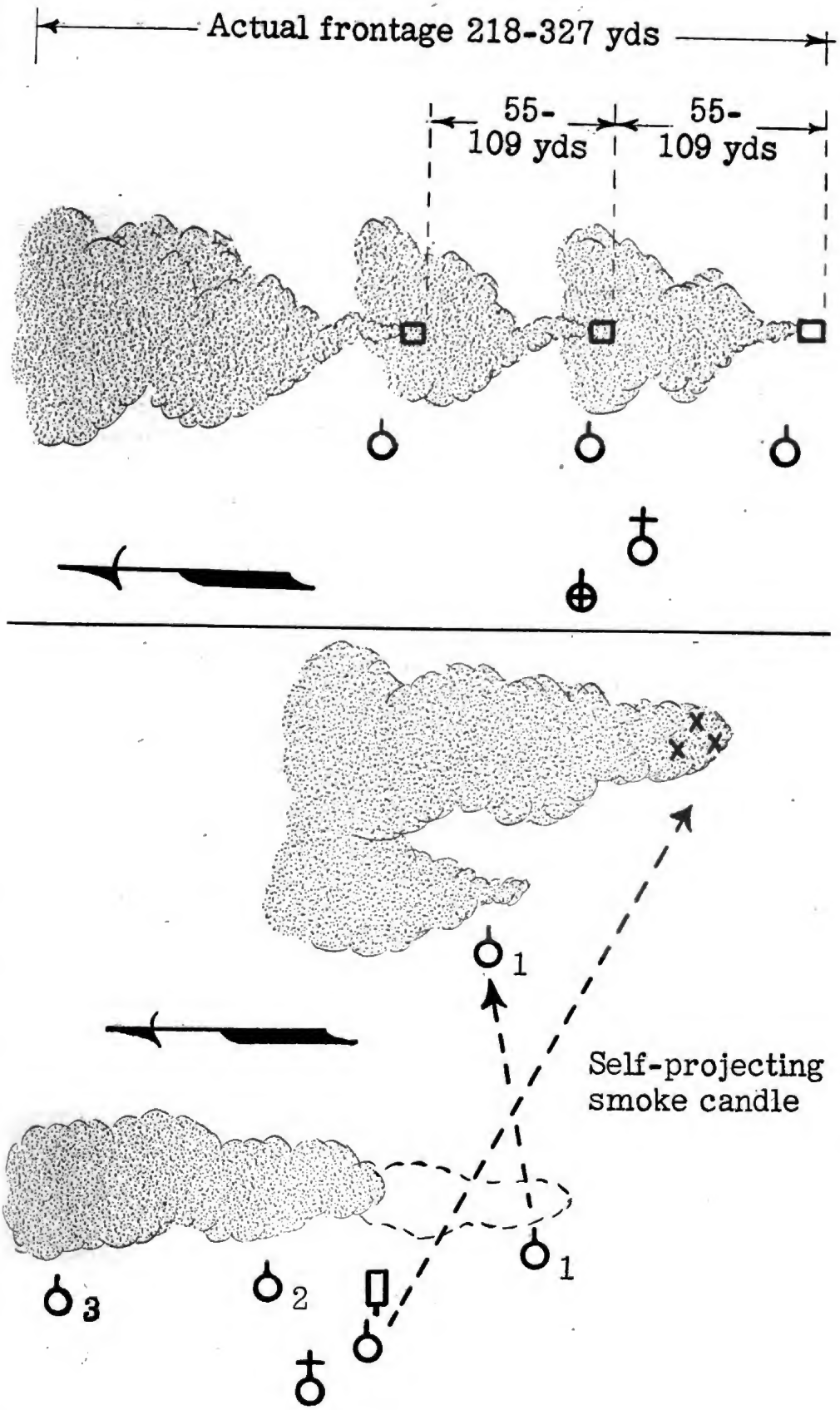
b. Stationary and Floating Smoke Candles. (1) *In following wind.* The men are placed at intervals of approximately 44 to 65 yards. When each man is responsible for a frontage of 65 yards, he discharges one candle in front of him, one 22 yards to the left, and another 22 yards to the right. When the frontage is only 44 yards per man, he ignites two candles only, one to the front and one to the right. The screen is maintained for as long as necessary, and any gaps that may develop are filled. To drive the smoke screen forward, the men advance to the next release point and repeat the process. See below and page 92.





(2) *In flank wind.* When driving the smoke screen forward (progressive screen) in a flank wind, a screen is started on the windward side and under its coverage the men advance in order from that side. A few self-projecting candles can be used to establish the subsidiary screen to windward and enable the men one by one to advance under cover and ignite stationary candles to establish a second screen closer to the enemy position. The average advance under these conditions is approximately 109 yards. See page 93.

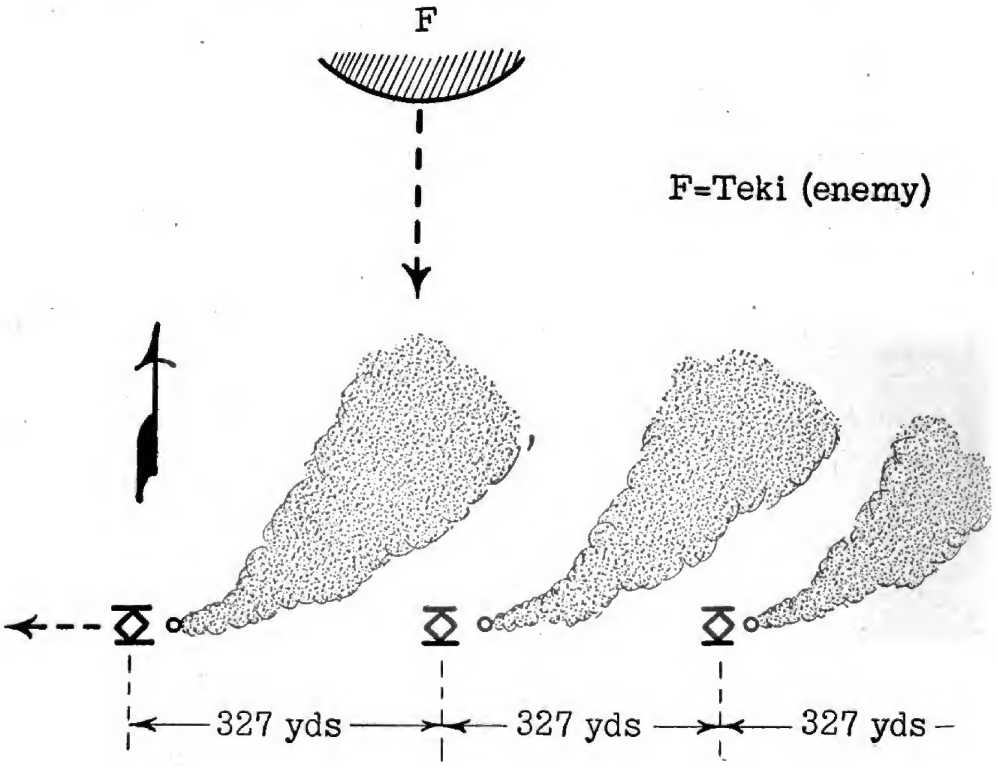
Large smoke candles and floating smoke candles are used in approximately the same manner as the small stationary smoke candles. One large smoke candle A will produce a screen approximately 763 to 1,090 yards long, varying in width from 22 to 55 yards at the upwind end of the screen to 55 to 76 yards at the downwind end. The same effect can be produced by 3 of the floating smoke candles A or by 10 of the small stationary smoke candles A. The screen produced by a single small stationary candle A is approximately the same as that of the self-projecting candle, although the emission time of the latter is only 1½ minutes, three-quarters that of the



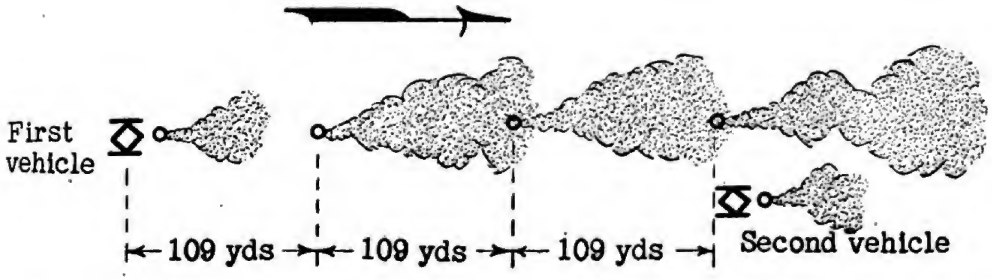
stationary candle. In firing large smoke candles or floating smoke candles, one squad takes care of 1 or 2 release points.

c. Production of Smoke Screens by Tanks. (1) *General.* The use of light tanks to place smoke screens between friendly and enemy troops is recommended by the Japanese. The smoke is discharged by smoke candles attached to the rear end of the tank, or thrown out from an opening in it, or by self-projecting smoke candles discharged from the tank turret.

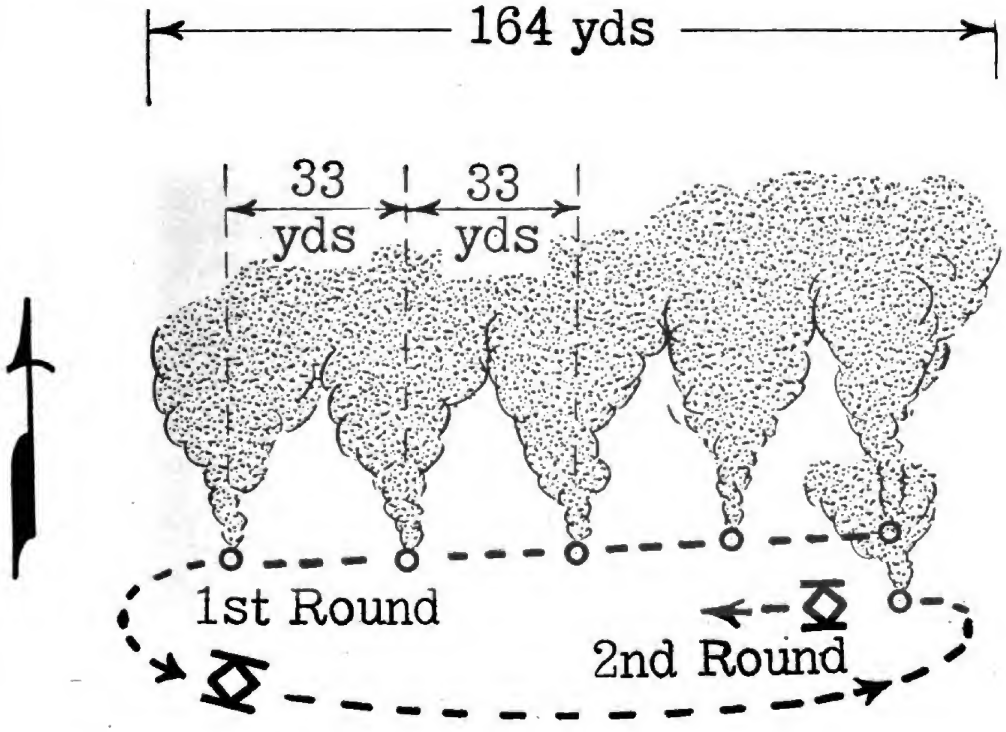
(2) *With following wind.* When the objective to be screened is small, the mission can be accomplished by one floating smoke candle, the tank proceeding at a speed of 6 to 9 miles per hour. For longer screens with a wind blowing toward the enemy, the average speed is 6 miles per hour, and as many as 3 tanks are used in line 327 yards apart. This calculation is based on the assumption that the smoke-producing munition is attached to the rear of the tank. Although this doctrine was held as recently as December 1941, it is difficult to imagine its successful use against an enemy even moderately supplied with antitank weapons. Possibly it was designed for use against Chinese troops who did not have antitank weapons.



(3) *With flank wind.* In flank wind the first tank heads into the wind and drops a smoke candle every 109 yards, followed by a second tank, 327 yards to the rear, which repeats the process to build up the screen and maintain it for a useful interval. The second tank is covered by the screen already laid by the first.



To establish a deep dense screen 1 tank is responsible for placing and maintaining a smoke screen across approximately 164 yards of front. The usual speed of 6 miles per hour is maintained, and small candles are thrown out at intervals of 33 yards. After the screen has been laid, the tank circles around to the starting point and repeats the process. Presumably a screen to cover a wider front would be established by using additional tanks to cover adjoining sectors, with sufficient overlap to make a continuous screen. A tail wind is required for this operation.



d. Movement in Smoke. Since adverse wind and weather often disperse smoke screens very quickly, Japanese troops are instructed to make use of the screening effect without delay, even though it may be necessary to move in the smoke. It is stated that troops are to be trained to operate in smoke, with special emphasis on maintenance of direction, the recognition of local terrain features, and the maintenance of liaison between units. Distances between troops must be shortened, as in night atacks, and prepa-

rations must be made for instant deployment to take advantage of the maximum concealment offered by the flow of smoke.

When using smoke, Japanese troops direct their fire towards an area in which it is not being used. They are also warned against having smoke at their backs when facing the enemy.

38. SMOKE IN ATTACK. a. In Landing Operations. (1) *Doctrine.* Smoke is recommended by the Japanese to cover landing operations, to prevent illumination of movements by searchlights, to interfere with hostile aimed fire, or to divert the attention of enemy troops from other developments. When placing screening smoke on hostile forces, the Japanese recommend combining it with toxic smoke.

At night, smoke is not to be used merely to interfere with searching tactics of enemy searchlights and artillery. According to Japanese tactics, it is to be used first when the advance ashore is opposed.

In a moderate wind, 10 to 20 floating smoke candles thrown upon the sea at the same time will form an effective cover for about 1½ miles. To produce a continuous frontal or flank smoke screen in a tail wind, floating candles are thrown out on the sea in pairs, with intervals of 22 yards between pairs.

An armored boat (presumably a landing craft) can carry about 150 floating smoke candles. Four to 7 men are required to fulfill a mission using smoke candles of the floating or ordinary type. Frontages assigned to smoke-emitting boats are about ⅝ of a mile to an armored boat and about 1¼ to 3 miles to a speed-boat. When the wind is blowing toward the landing point at a speed greater than that of the landing craft, the smoke screen is spread widely over the water. This is accomplished by having each boat emit smoke as it moves toward the landing point. As far as possible, each boat moves in the thin part of the screen. If there is a quartering wind or a head wind, personnel in the first boats to land should lay a smoke screen immediately, in front or to the flank, to facilitate the landing operation.

Artillery and debarkation work units on transports lay smoke screens over important points in the defenders' positions such as observation posts, searchlights, and flank-defense preparations.

Eight smoke candles discharged from a boat with a simultaneous firing device will cover a frontage of about 50 yards at the water's edge. Type 99 self-projecting smoke candles are fired, it is said, from about 350 yards off shore.[1]

(2) *Smoke plan for Lae landing.* Japanese plans for the use of smoke to screen the unloading of troops and supplies at and near Lae, New Guinea,

[1] It is difficult to understand the reason for this statement as the maximum range of the self-projecting candles is given as 327 yards, and it is believed that they will not function if they land in the water. In practice a shorter range probably would be used.

are revealed in one of their documents, which is paraphrased below. (See figs. 38 and 39.) Three *han* (at normal strength a *han* is roughly equivalent to our squad) were selected for the operations, under a first lieutenant. Each *han* was given responsibility for screening a separate area.

The No. 1 *Han* was composed of a sergeant major as leader, another noncommissioned officer, and 20 privates. It was allotted 6 collapsible boats. If needed, an armored boat or high-speed boat would also be allotted. This *han* was to use 200 smoke candles of the floating type, 10 of Type 94 (large), and 160 of Type 94 (small).

The Nos. 2 and 3 *Han* each were allotted a noncommissioned officer as leader, 15 privates, and the following equipment: 100 candles of the floating type, 7 of Type 94 (large), 120 of Type 94 (small), and three collapsible boats.

In addition to the equipment allotted to the above *han,* the Japanese document states, 400 of the floating-type candles "are to be kept in readiness" (probably as a reserve).

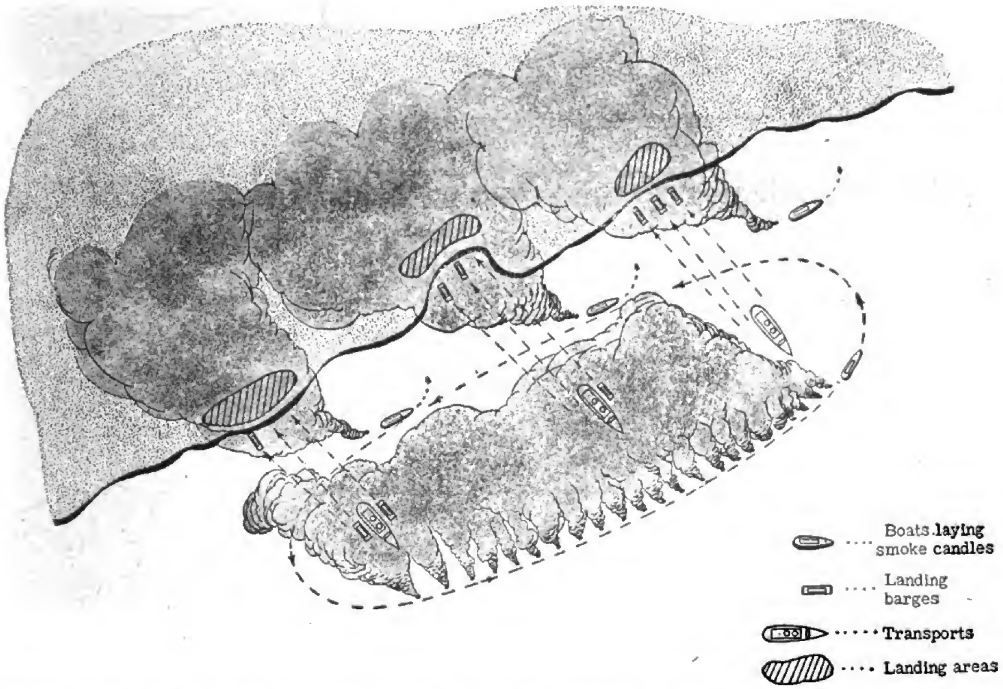


Figure 38. Target areas for Japanese smoke screens in landings at Lae and vicinity.

Regarding the actual operation, the document states that regulations for the formation of smoke screens should be based upon orders from Debarkation Unit Headquarters. At the beginning of operations, all smoke candles were to be lighted at the same time—when the signal shots (red-dragon parachute flares) were fired. The main smoke operations then were to be carried out by boats over the designated water area. Smoke operations also were to be conducted over land, according to circumstances.

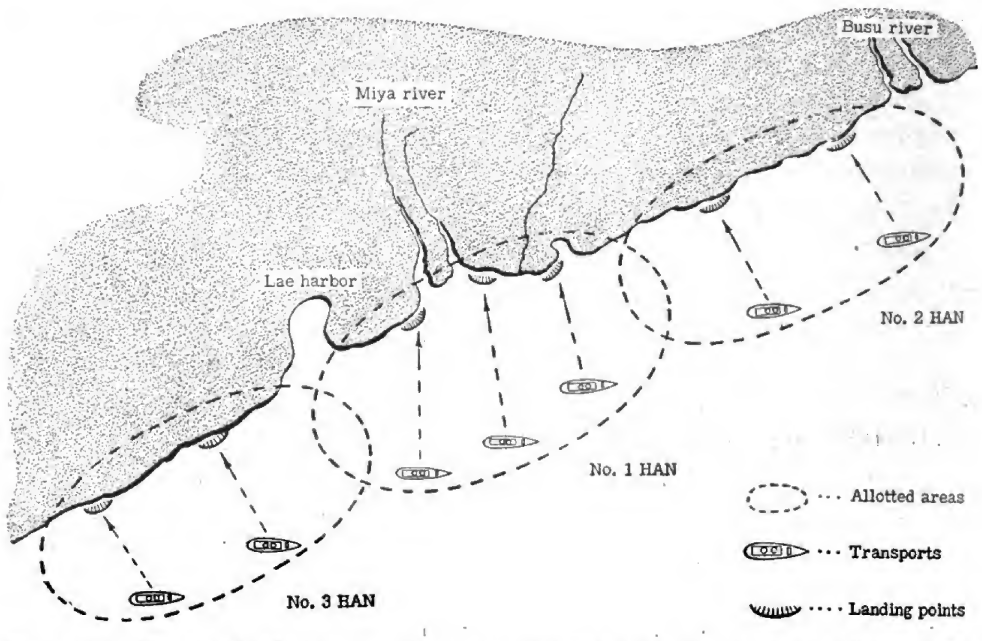
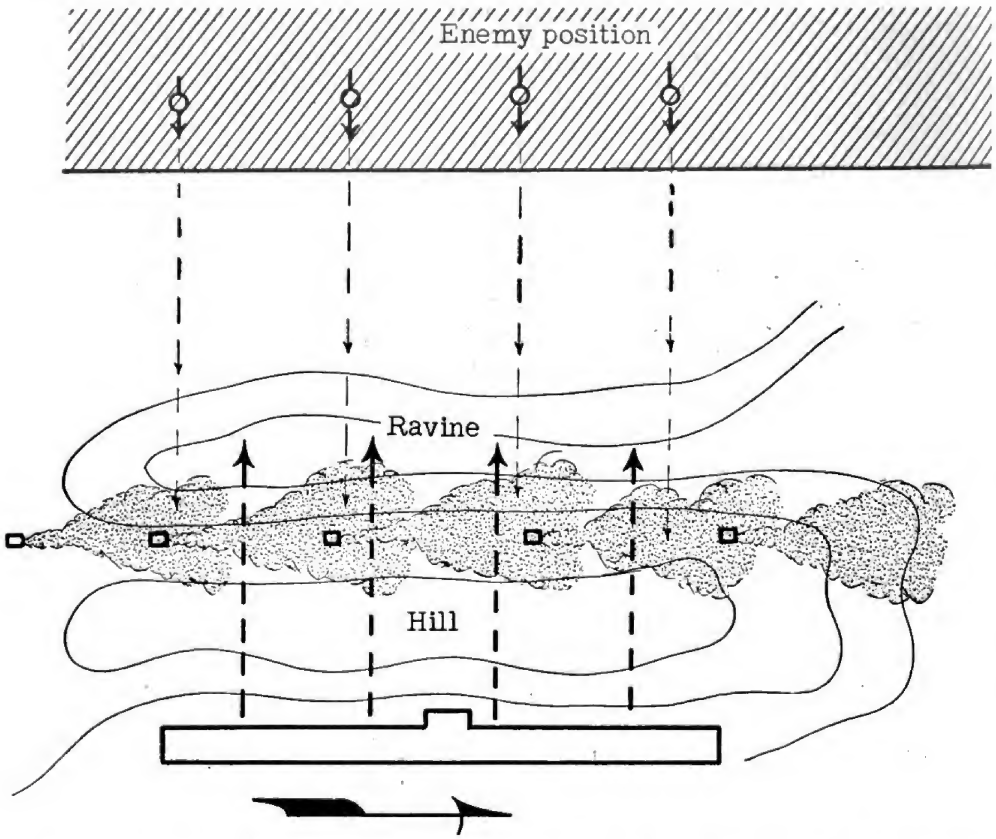


Figure 39. Expected effect of smoke screen planned for Japanese landings at Lae.

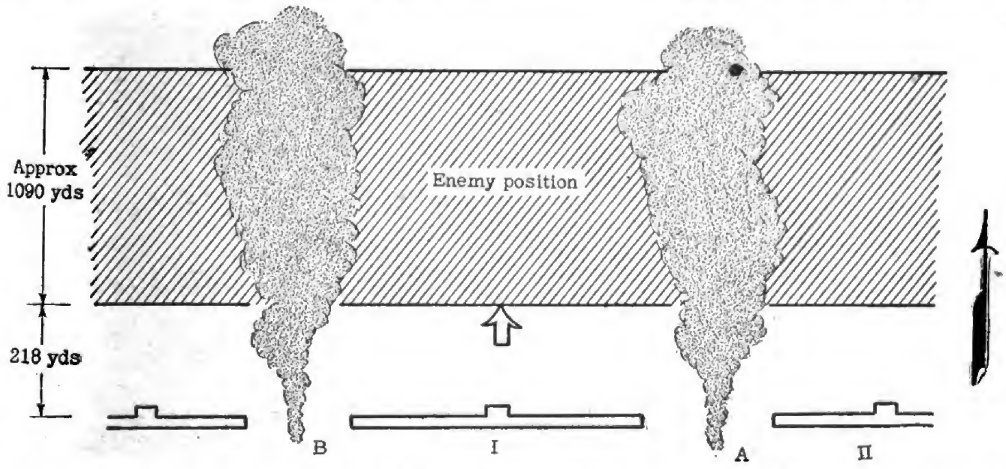


A study of the Japanese diagrams (figures 38 and 39) indicates that, in this operation, the enemy planned to lay a smoke screen over the designated

area by placing the floating-type candles at certain intervals in the water, and, if necessary, to operate the Type 94 candles on adjoining land areas.

b. In Setting Up a Line of Departure. The situation illustrated below is one in which the opposing forces are dug in at some distance from the Japanese lines and have an excellent field of fire over the intervening space. A smoke screen is used to permit Japanese forces to cross a hill under direct fire and gain the shelter of a ravine close to the opposing lines. From this point they will be in position to attack at an appropriate time. The width of the smoke screen should be greater than that of the attacking force, and it should be laid down before the advance in order to conceal the exact time of the movement, as is illustrated at the bottom of page 98.

c. In Frontal Attack. When the opposing forces are entrenched at a defensive position of some depth (approximately 1,090 yards). A portion



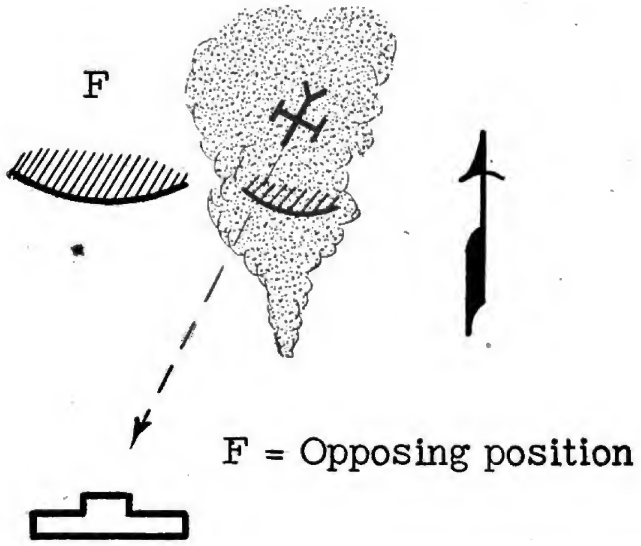
of their line is boxed in with two screens to prevent units on the flanks from coming to its assistance with aimed fire on the advancing Japanese. A 7 mile-per-hour wind is blowing from 6 o'clock, and the sun is not shining; so the smoke will stay close to the ground. The two screens are to be maintained for 20 minutes and are to be between 1,308 and 3,270 yards in depth. The methods of starting and maintaining the screen and the amounts of smoke munitions required at each release point are:

Types of candles	Number to be ignited at one time	Interval between ignition times to maintain screen	Quantity of candles required
		Minutes	
Small "A"	20	1	400
Floating "A"	7	5	28
Large "A"	2	4	10

d. For Deception. Smoke sometimes will be used to conceal the real direction of the main assault. A smoke screen is set up in front of the enemy position with or without accompanying shouts and firing of guns.

Simultaneously a flanking unit attacks from the side or rear. When spreading smoke for deception it is not always necessary to spread a complete screen. There may be gaps here and there, and the interval between release points will be wide enough to place a unit in between.

39. SMOKE IN DEFENSE. a. To Blind Opposing Fire. Smoke can be used on a rapid-fire machine gun position on the opposing flank to prevent direct aimed fire as illustrated in the following sketch:

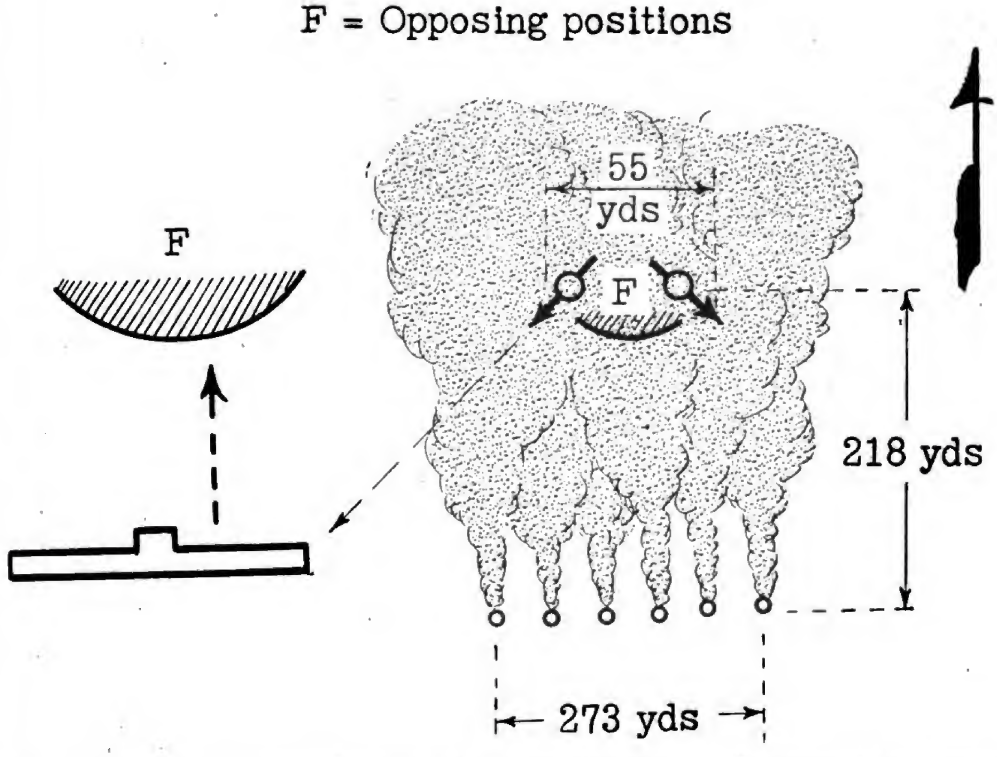


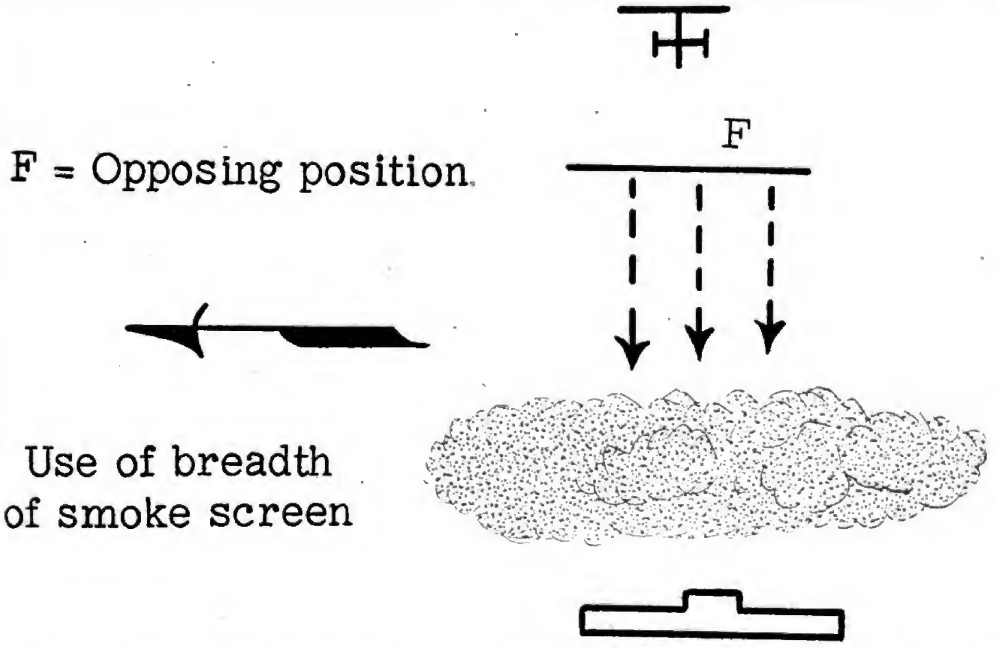
This operation is carried out with a small number of self-projecting candles. If these are not available, the same result can be achieved with stationary candles but at a considerably greater cost in matériel. To cover a target 55 yards wide at a distance of 218 yards, a screen is set up at the forward position with an initial width of 273 yards. Thirteen small candles at intervals of 22 yards are used at a time; 130 candles are required to maintain the screen for 10 minutes. The situation is illustrated at the top of page 101.

With a flank wind, an opposing field artillery gun position can be prevented from laying observed direct fire by starting a screen at one flank which will drift across between the two positions. Presumably this calls for the use of self-projecting candles. (See bottom of page 101.)

To avoid fire from opposing snipers, the Japanese also recommend the placing of smoke on their own forces. Such use of smoke to cover their own troops is to occur only when it is "unavoidable." They state that: ". . . it will draw the enemy's attention, thus interfering with our movement. This must be carried out at the farthest distance possible or over an extensive area. Or spread smoke in some other area to deceive the enemy, thus causing dispersal of enemy fire."

b. To Blind Attacking Enemy. A screen developed at the front line with ordinary candles can be placed over opposing forces to confuse them

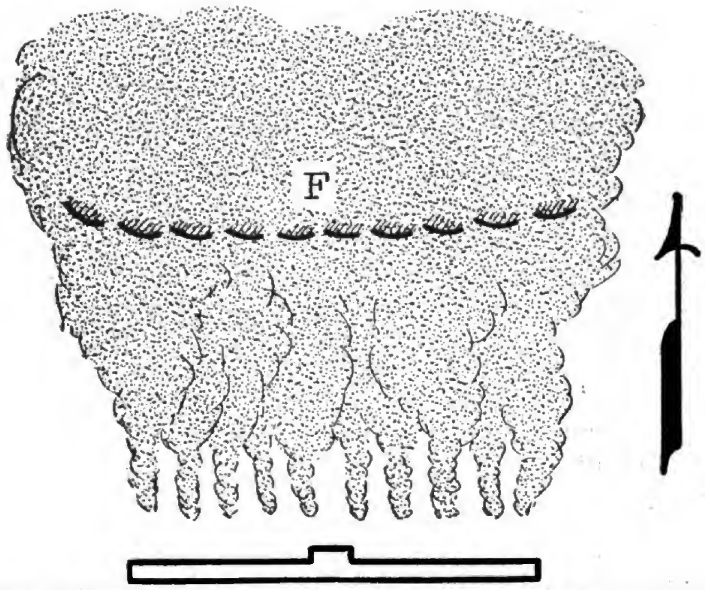




and render an attack ineffectual. This requires a wind blowing towards the opposing line, as illustrated at the top of page 102.

Section III. FLAME-THROWER TACTICS

40. GENERAL. The Japanese have used flame throwers in the current war since the early fighting in the Philippines before the fall of Bataan



and Corregidor. In May 1942 the Japanese radio at Tokio broadcast a description of a picture said to have appeared in a Japanese newspaper showing *chemical* units attacking one of the concrete fortifications of Corregidor with flame throwers. On the basis of reports available this use has not been widespread. Conditions peculiar to the terrain in which they have been fighting, largely jungle, may have affected their decision not to utilize flame throwers extensively.

In any case, they appear to be well equipped to use flame throwers on a much larger scale and may do so. It will be noted that as far as we know they have no intention of using massed flame-thrower tanks in attacks along the lines of German tactical doctrine. Their tactics, however, seem to take good account of the possibilities of the flame thrower.

41. FLAME-THROWER TROOPS. Flame-thrower companies are known to exist. Flame throwers also are organic weapons of engineers, 6 or 12 being authorized for the engineer regiment of the Japanese triangular division. Japanese infantry have also used the weapon.

42. FLAME-THROWER WEAPONS. Paragraph above describes the Japanese flame throwers with the exception of the flame-thrower tank. It is reported that a 38-ton tank, the Ishi-108, is armed with a flame thrower, two machine guns and two 37-mm guns. Japanese flame-thrower fuel is a mixture of gasoline, crude oil, and kerosene. The proportions of the mixture vary with the climate.

43. USE OF FLAME THROWERS. a. Capabilities. In a manual on "The Use and Effectiveness of Flame Throwers", the Japanese state that the purpose of flame throwers is to kill enemy troops or to cause fire or explosion at objectives, as well as to build up the morale of their own troops by causing the enemy to become panic-stricken.

b. Missions. In general, flame throwers are used to support the flank defense at the time of the assault or during the subsequent mopping-up operations. They also are used to capture strongpoints such as pillboxes and to attack tanks at close range. They may be used in direct support of an assault or, employed defensively on a broad scale, they can break up the enemy's assault.

(1) ***Attack on enemy flank defense.*** In the attack on special positions of the enemy, such as flank defenses, temporary neutralization is achieved by causing casualties among the defenders and by rendering ammunition temporarily unfit for use. To insure success, the flame-thrower attack must be followed up with explosives. Because of the black smoke and the toxic products of combustion emitted by the flame thrower it is impossible for the enemy to post fresh guards for about 5 to 10 minutes.

(2) ***Attack on pillboxes.*** The flame is to be directed through the loophole, which will cause it to strike the interior wall, refract and reach every part of the interior. If directed from the side at a 45° angle, the flaming oil will hit the wall of the loophole, refract, and penetrate the interior If the flame is discharged in bursts, even if directed blindly, it will reach the interior effectively. An accompanying diagram shows that the ideal distance from the machine-gun nest is about 11 to 22 yards, at which distance the fuel of the flame thrower is not in complete combustion. Since this range is less than the maximum, penetration will be good and the fuel will burn longer and more effectively within the objective.

(a) *Special assault detachments.* Reports speak of the organization by the Japanese of special assault detachments to attack pillboxes. These are composed of either engineer or infantry personnel, varying from 12 men under command of a noncommissioned officer to 30 men under an officer. The detachment is divided into 4 groups, each of which has carefully defined tasks to further the success of the entire detachment. The attack begins with a dive-bombing attack or artillery and mortar fire. This continues until the detachment reaches the wire obstacles in front of the pillbox. An obstacle group cuts lanes through wire obstacles, using bangalore torpedoes and wire cutters under cover provided by smoke candles and grenades.

An assault group is equipped with one or two flame throwers and some explosive charges for direct attack on the pillbox. The assault group, after going through the gap made in the wire, tries to occupy dead space below the pillbox or shell craters around it. They then attack all loopholes simultaneously with flame throwers or explosive charges.

A support party engages the objective with fire at close range to force the closing of loopholes and also attempt to keep down enemy fire on the flanks. Finally, a reserve party replaces casualties in the assault party, assists with the fire support and is responsible for mopping-up the interior of

the pillbox. It will be noted that this technique is strikingly like that of the Germans in attack on pillboxes.

(3) *Attack on tanks.* (*a*) *Tactical doctrine.* In an attack on a tank, the flame thrower can achieve the effect of temporary neutralization by causing casualties among the crew and by stopping the engines. Complete destruction is possible if followed by attacks with explosives. However, the best results are obtained by setting fire to the combustible parts of the tank's interior.

In experiments against a PT tank it was found that if the flame was directed straight at the turret only, the gunner and crew would be injured by the flame and the interior filled with black smoke making movement difficult for the time being. But the engine still would run. However, if the flame were directed at the air intakes the gunners and driver would be burned to death or injured, and the engine stopped because of insufficient air or burning of the spark plug cables.

As with pillboxes the recommended range of flame thrower attack on tanks is 11 to 22 yards.

(*b*) *Actual use against a tank.* A report describes an actual use of Japanese flame throwers against the leading tank of an American tank unit in the Philippines. As the tank drove between two large trees near the crest of a hill, sprays of liquid fell on both sides of the tank and burst into flame immediately, blinding the crew and filling the tank with smoke. This smoke was said to have no odor, choking, or other physiological effect on the crew. The tank continued a little way but got stuck, backed up, went forward, and got stuck again. The rear of the tank including the canvas port coverings for the guns also was ablaze. Later the crew had to abandon the tank. An observer in the second tank of this unit saw the engagement and said two Japanese stepped out from behind the two trees and sprayed the liquid up and down the tank apparently seeking to get into the opening in the rear of the tank. According to this observer, the liquid was first sprayed on the tanks and later set on fire. A shot from a 37-mm gun of the second tank is said to have hit one of the flame throwers, which went up in flames.

Section IV. INCENDIARY TACTICS

44. GENERAL. Like the Germans, the Japanese have a wide range of incendiary weapons. Their use presents few special tactical problems.

45. INCENDIARY WEAPONS AND MUNITIONS. The Japanese have cartridges for aircraft machine guns and incendiary shells for aircraft cannon, the grenade discharger, the 90-mm mortar and the 75-mm, Model 41, mountain gun (regimental gun). They also have three incendiary hand grenades, one of which can also be fired from the grenade discharger and another of which is of the "Molotov cocktail" type. Incendiary bombs are from 2 pounds to 559 pounds in weight.

46. TACTICAL USE OF INCENDIARY WEAPONS. a. Against Tanks. A Japanese document indicates the existence of two varieties of the "Molotov cocktail" grenade, Type A and B. Type A can be thrown from a distance of about 16 ft. Type B must be struck against the engine compartment of a tank and is not to be thrown. Special three-man and two-man teams are organized to make use of the weapons.

(1) *Three-man team.* Number 1 hurls the Type A incendiary grenade. If he sees that he has struck the target, he yells "a hit" and the others will not attack. If the hit is not accurate, Number 1 yells "a miss". The leader then attacks the tank with a pole mine, to damage the tracks and stop the tank. Subsequently, Number 2 will damage the guns by placing his mine underneath them. When Number 2 carries a Type B incendiary grenade or an armor piercing mine, however, he is to attack simultaneously with the leader.

(2) *Two-man team.* In this case, an attempt is made to guess the route of the tank and to attack it from two sides. The leader carries a pole mine and Number 2 carries a Type B incendiary grenade. Under certain circumstances the leader will attack first.

b. Against Planes. The Japanese have tried air-to-air bombing against American planes using time-fuzed incendiary bombs. The only point of tactical interest reported is that they have released such bombs from positions as much as 2,500 to 3,000 feet above American formations.